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OTITIS MEDIA AND MASTOIDITIS SIMULATING THROMBOPHLEBITIS OF THE LATERAL SINUS

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PHILADELPHIA

During the course of an otitic infection a patient may present septic symptoms leading one hastily to suspect an infection of the lateral sinus. However, on careful analysis one finds that during the course of otitis media or mastoiditis, before or after operation, other infections or concomitant complications often develop, such as cervical adenitis, pyelitis, pneumonia and nephritis, which present symptoms that are similar to those of thrombosis and phlebitis of the lateral sinus. It has been observed also that in acute mastoiditis of the hemorrhagic type sepsis is an early symptom. There is extension to the general circulation, and the infection of the blood stream is independent of the lateral sinus.

After mastoidectomy, septic symptoms may manifest themselves as a result of (1) incomplete mastoidectomy, (2) osteomyelitis of the temporal bone, (3) petrosal involvement, (4) extension of infection to other bones of the cranial vault and (5) contiguous involvement of adjacent soft structures.

All septic conditions present a common group of symptoms: abnormal temperature, chills, headaches, changes in the blood picture and occasionally infection of the blood stream, as shown by positive blood cultures. The presence of such symptoms in conjunction with suppuration of the temporal bone often leads one to ascribe them hastily to phlebitis and thrombosis of the lateral sinus rather than to some other pathologic process.

It would not be amiss to discuss briefly the general symptoms of sepsis.

Abnormal temperature is the outstanding symptom. The typical temperature is the steeplechase, or spiked, variety. However, the temperature may be sustained during the course of an otitic infection and preceding the onset of such complications as erysipelas, pneumonia, meningitis, tonsillitis or infection in the opposite ear. Only by watch-

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ful waiting and close cooperation can the true status of the condition be determined. Paradoxically, prolonged administration of sulfanilamide in the treatment of a septic patient may produce a fever of the intermittent type, which does not subside until the administration of the drug is stopped and the drug is eliminated from the system.

Chills are present in about 50 per cent of patients with sepsis. The infection is often ushered in by a chill, the subjective and objective manifestations of which vary from coldness of the extremities to a feeling of chilliness, rigor and even profound prostration and cyanosis.

Sweating invariably follows the rise of temperature and should be evaluated when it is present. Profuse sweats often terminate in prostration.

Convulsions are rather infrequent in adults. They may occur as a result of toxemia, especially in children.

Cyanosis often supplants chills as a symptom. It is well to remember that cyanosis is often caused by the administration of sulfanilamide.

The pulse rate invariably parallels the temperature, but in the presence of such complications as meningitis and cerebral or cerebellar abscesses bradycardia may develop. In prolonged illness with protracted fever and sepsis, myocardial failure often occurs. The pulse rate then becomes rapid, and its curve crosses the descending temperature curve.

At the height of the fever and during the chill, the patient is likely to be drowsy and apathetic, but as soon as the temperature subsides the mentality clears, and there is a feeling of well-being.

The blood cultures are positive in 55 to 60 per cent of cases of thrombosis or phlebitis of the lateral sinus. However, at times I have obtained positive cultures in the presence of other complications, such as pneumonia, tonsillitis, acute endocarditis and erysipelas, and after operation on the hemorrhagic variety of mastoiditis. This finding in itself should not be the sole basis for diagnosis of thrombosis or phlebitis of the lateral sinus.

In cases of sepsis, the hemograms reveal secondary anemia. A progressive reduction in the number of red blood cells and in the hemoglobin content indicates a hemolytic infection. Leukocytosis is present, and a differential study reveals immature white cells and a shift of the Schilling index to the left.

The spinal fluid does not reveal any chemical or cytologic changes unless there is complicating meningitis.

I have repeatedly observed a negative Ayer-Tobey reaction in the presence of thrombosis of the lateral sinus and a positive Ayer-Tobey reaction in patients without a thrombus. Therefore, positive or negative findings in the Ayer-Tobey test are of value only in conjunction with the entire clinical picture.

Metastasis occurs in many cases independently of involvement of the lateral sinus. Many infections begin with septicemia, and the ear is not always the primary focus. For example, a sore throat might produce septicemia, and the otitic involvement would then play only a minor role in the infection.

I should like to present 5 cases which clearly demonstrate my contention that in the presence of suppuration of the temporal bone sepsis may be due to causes other than phlebitis and thrombosis of the lateral sinus.

These exemplary cases were selected from a large group: they were carefully studied from all angles, with full cooperation from the internist, the pediatrician, the roentgenologist and the laboratory technician.

In the course of my analysis I shall endeavor to emphasize the classic signs and outstanding symptoms as they present themselves. Because of the similarity of symptoms an erroneous provisional diagnosis of sinus phlebitis and thrombosis could readily have been made, but the final outcome in these cases has proved that other forms of sepsis existed.

REPORT OF CASES

Case 1.—J. B., a white boy aged 9 years, presented the following history: He was apparently well until March 27, 1936, when he became ill with a sore throat. Seven days later acute otitis media developed on the right, with spontaneous perforation. Three days afterward otitis media developed on the left side, and a myringotomy was performed. During the next ten days the patient suffered from a profuse aural discharge, pain over the mastoid process, intermittent fever, with the temperature ranging from 99 to 104 F., headache, chills and recurrent sweats. On physical examination, the heart and lungs appeared normal. Roentgen examination showed evidence of mastoiditis. A blood count showed the red cells and hemoglobin reduced, with marked secondary anemia. The white cell count disclosed leukocytosis, with a shift to the left. Bilateral mastoidectomy was performed, but the sepsis did not subside. On two successive days after mastoidectomy blood cultures were positive. The organisms isolated were Streptococcus haemolyticus. Examination of the eyegrounds gave negative results.

The Ayer-Tobey test gave a positive result on the right side. The mental state of the patient was clear, and during the recession of the temperature he felt well.

A critical analysis of all the symptoms presented pointed toward disease of the lateral sinus. A revision of both mastoids was performed, the right lateral sinus being opened, but no pathologic condition was found. The mastoidectomy wounds disclosed some granulation tissue, but there was no bony necrosis. The usual therapy was instituted, consisting of transfusions (this was prior to the introduction of sulfanilamide therapy) and injections of nonspecific serums, without any improvement.

One day, during an examination of the patient, petechial spots were noted in the left antecubital region. Shortly afterward, the cardiologist obtained positive evidence of the existence of endocarditis. Under the proper therapy, the patient eventually recovered.

Comment.—This was a case of bilateral mastoiditis in which the otitic infection produced a flare-up of latent endocarditis, or the endocarditis was the result of the otitic infection. In any event, the surgical intervention on the lateral sinus did not hasten the patient's recovery.

CASE 2.—J. G., a white girl aged 8 years, presented the following history: On July 10, 1938, she went swimming; as a result she contracted an infection of the upper part of the respiratory tract. Two days later otitis media developed on the right. Incision was done thirty-six hours after the onset. At that time, the girl had a temperature of 104.5 F., a slight cough and a discharge from the right naris. She had no headache or pain over the sinuses. For the next ten days the otitis media and sinusitis on the right side persisted. The blood count revealed 3,000,000 red cells with 70 per cent hemoglobin. There was leukocytosis, the white cell count ranging from 14,000 to 18,000. The Schilling index showed a marked shift to the left. Roentgenograms of the mastoid disclosed exudative mastoiditis, but otoscopically there was little evidence of involvement of the mastoid. Occasionally the patient complained of chills, and slight cyanosis was noted. At times there were nausea and vomiting. The blood culture was negative. The temperature was of the intermittent type, ranging between 97 and 104 F. Analysis of the urine persistently gave negative results, except for the low specific gravity. The cardinal signs and symptoms were intermittent fever, chills, sweats, occasional nausea and vomiting and changes in the hemograms in addition to the otitic suppuration and roentgen evidence of a pathologic condition in the mastoid.

A roentgenogram of the mastoid made at this time did not reveal further changes. The condition of the patient became alarming because of the toxemia, the recurrent severe chills, which were followed by prostration, and the persistent high temperature. Since no other findings explained this sepis, the mastoid was explored. At operation little pathologic change was noted. The symptoms remained the same despite the surgical intervention, for ten days. Then there was a sudden drop in the temperature, with amelioration of all other symptoms. The urine at this time disclosed huge quantities of pus, and it became evident that the septic symptoms had been due to the retention of the pus in the kidney. As soon as the loculation emptied itself the sepsis subsided.

Comment.—This picture is one of a septic patient with otitic suppuration. There was scant evidence of mastoiditis, but the alarming symptoms warranted exploration of the mastoid. The true state was eventually revealed as pyelitis. It is worth while to bear in mind that 4 per cent of all abnormal temperatures of unknown origin in children are due to pyelitis.

CASE 3.—C. S., a white boy aged 3 years, on March 6, 1935, became ill with an infection of the upper part of the respiratory tract and bilateral otitis media. Two weeks later, on admission to the hospital, he presented the following symptoms: intermittent elevation of temperature to 103 F., nasal discharge and slight cough. Roentgen study revealed infection of the left maxillary and ethmoid sinuses and bilateral mastoiditis. Examination of the chest gave negative results physically and roentgenologically. Otoscopic examination disclosed profuse suppuration in both ears and narrowing of the canals. There were tenderness over

the emissary vein and pain over the mastoid antrum on palpation. The patient appeared toxic and anemic. The hemograms disclosed leukocytosis, the white cell count ranging between 15,000 and 18,000, and a shift of the Schilling index to the left. There were secondary anemia and a tendency toward destruction and degeneration of the leukocytes.

Sixteen days after the onset of the illness a bilateral mastoidectomy was performed. At operation a thickened periosteum, pus, granulation tissue and sequestration were found. The operation was performed with the patient under anesthesia induced by avertin with amylene hydrate and local anesthesia. On the first postoperative day the temperature rose precipitantly to 105 F., but it receded slightly during the next forty-eight hours. On the fourth day after operation it again reached 105 F., the fever being accompanied by a slight chill and perspiration and frequent coughing. The blood now disclosed a marked reduction in the number of red cells and in the hemoglobin content, leukocytosis, the white cell count ranging between 14,000 and 19,000, and a marked shift of the Schilling index to the left. Physical examination of the chest revealed no abnormality. The Ayer-Tobey test indicated involvement of the left lateral sinus. Palpation of the neck disclosed slight tenderness along the anterior border of the sternocleidomastoid muscle. Roentgen examination of the chest at this time showed no abnormality.

Six days after the operation the excursions of the temperature ranged between 97 and 105 F. The cough was slightly increased. Another roentgen examination of the mastoid did not disclose any residual diseased bone, while roentgenograms of the sinuses showed improvement. The blood cultures were negative.

Critical analysis of this case disclosed the following outstanding symptoms: (1) septic temperatures, (2) headache, (3) slight cough, (4) abnormal hemograms, (5) positive results of the Ayer-Tobey test for involvement of the left lateral sinus. This pronounced septic picture in the presence of bilateral mastoiditis would influence one toward the diagnosis of phlebitis or thrombosis of the lateral sinus. Examination of the chest at this time disclosed a slightly prolonged expiration and a few crackling rales. Roentgen examination of the chest gave indefinite results. In view of the suspicious symptoms referable to the chest a conservative attitude was adopted, and therefore no surgical procedure was instituted.

Ten days postoperatively roentgen examination showed evidence of bronchopneumonia. Within twenty-one days all symptoms subsided, and the patient made an uneventful recovery.

Comment.—In this patient bronchopneumonia was associated with bilateral mastoiditis. The septic symptoms after operation simulated phlebitis and thrombosis of the lateral sinus. It was only the slightest suspicion of involvement of the chest that caused the adoption of a conservative attitude and the consequent avoidance of an unnecessary operation on the venous structure.

Case 4.—W. B., a white boy aged 6 years, was ill with an infection of the upper part of the respiratory tract in April 1938; after three days severe pain in the left ear developed, with a temperature of 103 F. A myringotomy was performed by the family physician. This was followed by a serosanguineous discharge without abatement of the symptoms. Five days after the onset of the illness, the right ear became involved. Otologic examination at this time disclosed otitis bullosa externa. The left ear also presented blebs in addition to the sero-

sanguineous discharge. The blebs were not punctured but were treated medically. On the seventh day there was a sudden rise in the temperature, with chills. Otoscopic examination now disclosed bilateral otitis media, and myringotomy released a thick purulent discharge from both ears.

Nasal examination disclosed bilateral suppurative maxillary sinusitis. Subjectively the patient complained of frontal headache, heaviness of the eyes, occasional nausea and vomiting and retro-orbital pain. The sinuses and the ears were treated, but fever, sweats and prostration continued. The temperature ranged between 99 and 103.5 F. for ten days. The blood counts disclosed 3,200,000 red blood cells with 70 per cent hemoglobin, and leukocytosis (15,000 to 23,000 cells. The discharge from the ear was profuse and had a greenish tinge. Otoscopically and clinically there was evidence of bilateral surgical mastoiditis. Roentgen findings disclosed pathologic changes in the antrums and ethmoid sinuses and revealed active destructive mastoiditis.

On the nineteenth day after the onset of the illness a bilateral mastoidectomy was performed. The finding at operation was necrosis of bone with cavitation. For four days postoperatively the temperature subsided to 100 F., after which the septic symptoms recrudesced. There were also several mild chills. All sutures were removed; the wounds were opened widely and inspected, and no residual pathologic condition was found in the mastoid region.

The Ayer-Tobey test gave a positive result on the right side. A blood culture was negative, while the hemograms continued to show evidence of infection. Therapy consisted of blood transfusions, administration of sulfanilamide by mouth and hypodermic administration of prontosil.[1] Punctured antrums disclosed thick pus on the right side. It was impossible to ventilate the left maxillary antrum because of the obstruction of the ostium. Irrigation was accomplished by the use of two needles, through the inferior meatal route. It was impossible to catheterize the natural ostiums at any time.

The septic symptoms continued for three weeks without improvement, until the infection in both antrums cleared up.

Comment.—The septic symptoms were due to infection in the nasal accessory sinuses. I recently had a patient with sphenoiditis who presented an identical clinical picture.

Case 5.—K. J., a white boy aged 9 years, had influenza three weeks prior to admission. This became complicated with suppurative otitis media on the right. A myringotomy was performed without abatement of the symptoms. One week later a simple mastoidectomy was performed by another otologist.

When the boy was admitted to the Temple University Hospital, the following symptoms were present: a temperature of 105 F., slight nuchal rigidity and profuse discharge from the middle ear and the mastoid wound. Secondary anemia was present, with leukocytosis (19,000 cells) and a shift of the Schilling index to the left. The child complained of headache, with fleeting labyrinthine symptoms, such as vertigo and nystagmus. The Crowe-Beck sign was positive. Increased intracranial pressure was evidenced by increased pressure of the spinal fluid and choked disk of 2 diopters. The result of the Ayer-Tobey test was positive.

The postauricular wound was slightly discolored, with a profuse and offensive purulent discharge. The Griesinger sign was present. Palpation of the neck dis-

1. The disodium salt of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3′,6′-disulfonic acid. This is the substance previously known as prontosil soluble and now to be called neoprontosil.

closed pain and tenderness along the anterior border to the sternocleidomastoid muscle. Culture of the blood gave a negative result. The roentgenogram revealed residual pathologic changes in the mastoid process.

Revision of the mastoid disclosed that an incomplete mastoidectomy had been done, and many necrotic cells were found in the perilabyrinthine and zygomatic regions.

Comment.—This patient presented symptoms of sinus thrombosis and phlebitis and was referred to me with a provisional diagnosis of involvement of the lateral sinus. After a complete mastoidectomy, all signs of sepsis disappeared, and the patient made an uneventful recovery.

HEMORRHAGIC MASTOIDITIS

Acute hemorrhagic mastoiditis is a distinct clinical and pathologic entity. From the onset of acute otitis media septic symptoms are often present, and they are ushered in with chills, high temperature, marked prostration, extreme restlessness and overwhelming toxemia.

In infants and children characteristic symptoms are extreme illness, gastrointestinal disturbances, high temperature and meningeal signs.

The otitic picture begins with severe diffused redness of the tympanic membrane without marked bulging.

Hemorrhagic mastoiditis presents two distinct classic pathognomonic findings when myringotomy is performed: (*a*) the escape of a thin fluid, which remains scanty and serosanguineous throughout the course of the infection; (*b*) profuse bleeding, which is often difficult to control.

The pain and the sepsis persist despite the myringotomy. The patient is so ill and septic during the period of otitis media that one is likely to become unduly alarmed and be in haste to perform a simple mastoidectomy.

When mastoidectomy is performed early, the septic symptoms become more pronounced. At this time the laboratory findings may disclose a positive blood culture, and the most prevalent organism is Str. haemolyticus, although occasionally one finds Bacillus influenzae.

The blood count shows secondary anemia with a diminution in the hemoglobin and red blood cells. There is leukocytosis, the white cell count ranging from 15,000 to 20,000, with polymorphonuclears ranging from 80 to 90 per cent and a marked shift of the Schilling index to the left.

Occasionally in hemorrhagic mastoiditis venous congestion results in an engorgement of the veins of the scalp, marked edema over the mastoid and the appearance of the so-called Griesinger sign. The eyegrounds may show a choking of several diopters.

Comment.—Sepsis, prostration, chills, occasional positive blood cultures, positive hemograms and occasional choked disk would lead one to suspect phlebitis or thrombosis of the lateral sinus, but in actuality these symptoms are due to hemorrhagic mastoiditis.

OSTEOMYELITIC PHENOMENA

There are two types of osteomyelitic phenomena, the subacute and the fulminating. The subacute type may present septic phenomena, but in a short time it can be readily diagnosed.

I am primarily interested in the acute fulminating type, which may involve the mastoid process, the petrosa or any portion of the temporal bone.

The acute fulminating type of osteomyelitis is followed by a train of symptoms, the most frequent being an elevation of the temperature, sustained, remittent or intermittent, accompanied by occasional chills, sweats and prostration. One might stress the significance of the severity of the symptoms and the rapidity of the deterioration of the general condition of the patient. As a general rule, the course is stormy, because the infection spreads by continuity and contiguity. This condition may sometimes be confused with phlebitis or thrombosis of the lateral sinus.

There is a form of acute osteomyelitis of the petrous portion of the temporal bone, described by Ramadier, and most frequently found in children, which spreads by the hematogenous route. It occurs in the young and produces infarcts of the kidneys and lungs; blood cultures may be positive, and the general symptoms are most severe. This type of infection causes wide destruction and has no respect for anatomic boundaries. Fortunately, it is infrequent. The symptoms run parallel with those of phlebitis and thrombosis of the lateral sinus. The sepsis is due to the osteomyelitis, and operation on the lateral sinus is contraindicated because the lateral sinus does not participate in this type of sepsis.

Comment.—When operation on the mastoid is performed early, before localization takes place, the patient faces a rather stormy course with a protracted convalescence. During this period the septic symptoms closely simulate those of sinus phlebitis or thrombosis.

In my experience I have found that there is no emergency requiring immediate institution of surgical procedures in phlebitis and thrombosis of the lateral sinus; with conservative measures time may reveal that the sepsis was due to other causes.

SUMMARY

When sepsis occurs in conjunction with suppuration of the temporal bone, one is led to believe that phlebitis and thrombosis of the lateral sinus are responsible for the sepsis in 100 per cent of the cases. However, actually, the incidence of sinus thrombosis and phlebitis in otologic diseases is only 2 per cent.

Each case of sepsis is entitled to deliberate and deep consideration from a medical and surgical standpoint.

The elements concerned in the causation and manifestation are so numerous that it becomes easy to err. Therefore, the surgical treatment of the lateral sinus should not be an emergency measure but should be instituted only after a period of conservative treatment and long deliberation.

The pathologic picture, the anatomic variations, the virulence of the organism and the resistance of the patient are factors which must be considered.

Such infections as erysipelas, lobar pneumonia, endocarditis, empyema and tonsillitis may be primary, concomitant with or sequential to suppuration of the temporal bone and may produce virulent septic symptoms which can be readily misinterpreted as phlebitis and thrombosis of the lateral sinus.

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HEARING AIDS

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Recent improvements in electrical hearing aids, released with confusing frequency by competing manufacturers, have imposed on the otolaryngologist new responsibilities and problems. His aurally handicapped patients confidently look to him to prescribe hearing devices or to give specific help in the selection of those best adapted to their individual requirements. To render this service satisfactorily requires a certain amount of elementary knowledge of the construction, performance and limitations of these instruments.

To make more clear some of the physical features involved in the application of hearing aids we present some of the acoustic phenomena concerned in the problem.

In the normal process of communicating ideas by speech there are several indispensable elements, namely, the speaker, the listener and a path of sound transmission. To insure a high degree of understandability each element of the combination must function properly; that is,

1. Enunciation must be clear and loud.

2. The listener's hearing must be normal.

3. The path of sound transmission must be free from echoes, reverberation, interfering noises or distortion.

The several elements involved are shown diagrammatically in the upper part of chart 1. Part of the path of transmission lies within the listener, as shown by *DE*. In the lower part of chart 1 is shown diagrammatically how the level of the loudness of speech may vary from the speaker to the listener.

Now suppose the intensity of the sound is insufficient for the listener. This insufficiency may be due, as shown diagrammatically in the upper part of chart 2, to either of two causes: (1) loss of loudness in the path of transmission or (2) loss of hearing in the listener.

To remedy this condition of insufficient intensity of sound for the listener, amplification may be resorted to, with the result shown in the upper diagram of chart 2. A loss of hearing of 50 decibels in the

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* From the University of Minnesota.

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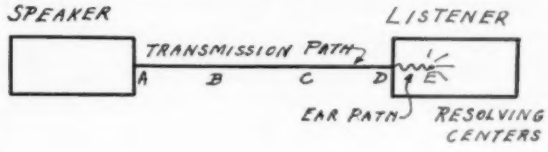
listener (DE) is compensated by amplifying the sound externally as shown at BC.

Thus far we have assumed that speech is transmitted as a whole and that all its parts are transmitted equally, but in reality the phenomenon is more complicated, because speech is not like a simple



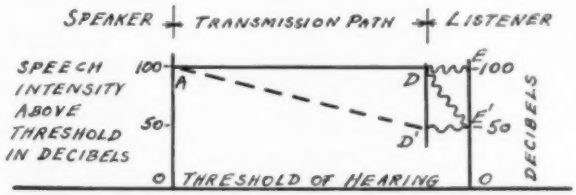
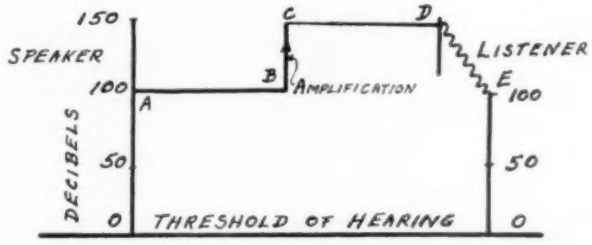


Chart 1.—Above, components of speech transmission. Below, levels of loudness in speech transmission.



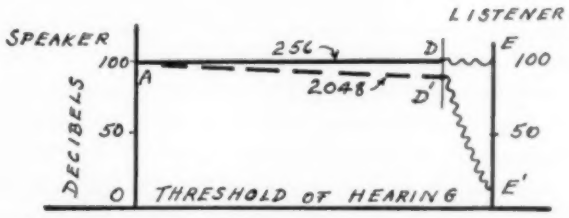


Chart 2.—Above, levels of loudness with loss of hearing in the listener compensated by gain in the amplifier. Below, different losses in a listener at two frequencies.

tone but consists in its most important range of a band of tones ranging from 100 to 4000 vibrations per second. If, for example, we take two tones, 256 and 2048 vibrations per second, a possible condition of vibration is that depicted in the lower diagram of chart 2, in which

the listener's ear has no loss for 256 but a 90 decibel loss for 2048 vibrations per second. Now we may inquire: How does speech distorted in this fashion sound to the listener? To find out we need only cause between the speaker and the listener (who has normal hearing) the same kind of loss in transmission as the person with defective hearing has in his hearing mechanism. By means of a loud speaker system and a distorting network, the normal listener can be made to have effectively the hearing represented by curve *AA* in the audiogram, chart 3.

It will be observed that two things happen when the listener who has a normal hearing mechanism is afflicted as indicated in the audiogram by curve *AA*. First, the loudnesss of the speech sound is greatly reduced; second, the character of the sounds is greatly altered. But

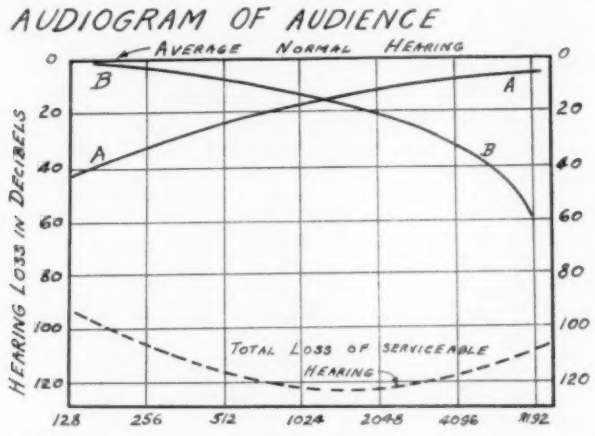


Chart 3.—Conductive (*AA*) and perceptive (*BB*) loss of hearing simulated by external distortion.

when the amplification is increased, speech is still clear and understandable. Apparently, then, the ear which is defective only by reason of a nonuniform loss of conduction is capable of accommodating itself fairly well to this type of distortion of speech, provided the speech sounds are loud enough.

Similarly the listener with normal hearing can be made to have the loss in hearing shown by curve *BB* in chart 3. Here again we believe it will be agreed that the speech can be understood fairly well although the distortion is severe and of a different character from that indicated by curve *AA*. It should be emphasized, however, that distortion of the kind produced is similar to loss of conduction in a patient. Obviously a defect in hearing caused by a failure in the resolving powers of the ear cannot be simulated in a normal ear by external distortion.

But there is still another type of external distortion of speech, of an altogether different kind, which has the property not of subtracting from the normal speech sounds but of adding noise components. These noise components disturb the listener so that, even though the wanted speech sounds are all present, the noises obscure or mask them. This form of distortion is a common fault of electrical hearing aids which have carbon microphones. It may be illustrated by amplifying the speech sounds as they emanate from one of the cheap and unacceptable carbon microphone hearing aids. It is agreed that speech sounds so garbled are difficult to understand and nerve-wracking to listen to. Some effect of this kind is present even in the best of the carbon type aids. On the other hand the vacuum tube hearing aids with crystal or condenser microphones when properly designed are comparatively free from this kind of distortion, and it is because of this that they give superior results.

In prescribing hearing aids one classifies patients on the basis of degrees of deficiency in hearing and preponderance of conductive or perceptive loss. Persons whose loss is moderate and fairly uniform through the speech range are easily fitted with a carbon microphone aid. Those who have a severe loss, especially for the higher frequencies, present a more difficult problem.

The information afforded by an audiogram for both air and bone conduction is invaluable. This information may be obtained with less accuracy by time-consuming tuning fork tests. The audiogram definitely indicates whether an air conduction or a bone conduction receiver should be used. It shows the degree of amplification required at different frequencies to compensate for the patient's deficiencies and whether his needs can be satisfactorily met by a carbon microphone instrument, with or without an amplifier, or whether his loss is such as to require a vacuum tube aid, with its still greater amplification and fidelity.

The fitting of hearing aids by closely matching the audiogram at many points, as at octave letter intervals, by selective amplification, as has been proposed, imposes a requirement which to many seems unnecessarily severe. Further scientific investigation will decide this question with certainty.

Improvements in the range and quality of the performance of hearing aids, the development of selective amplification and the perfection of wearable vacuum tube instruments have increased greatly the field of application of electric hearing devices. Until lately, because of their limitations, carbon devices could not be tolerated by the average person unless his loss of hearing in the better ear exceeded 35 to 40 decibels. Today the improved carbon instruments yield such relatively excellent performance that many persons whose loss is only 25 to 30

decibels use them with great comfort and satisfaction. Physicians and educators should note that many young children with a loss of hearing so great that it prevents acquisition of speech in the normal way can now learn to talk as well as normally hearing children do by using a modern hearing aid at home and in the school.

The manufacturers of hearing devices should be given credit for two notable contributions to the cause of better hearing:

1. By greatly improving the performance of their products they have made it possible for a constantly increasing number of persons to supplement their defective hearing successfully and so to insure their economic and social status.

2. Their extensive advertising of better hearing devices has served indirectly to stimulate wider interest in the problem of conserving the hearing, to overcome largely the existing prejudice against the wearing of a hearing aid and to increase employment of those handicapped by a loss of hearing, since it is known that the defect can be compensated.

The American Medical Association, through the Council on Physical Therapy, of which Mr. Howard A. Carter is secretary, and its Committee of Consulting Otologists, of which Dr. A. A. Hayden is chairman, is generously rendering a valuable service in a serious attempt to formulate specifications of the minimum standards for the construction and performance of hearing aids. Already it has raised to a higher ethical level the advertising, distribution and servicing of these appliances. To date the products of five of the larger manufacturers have been approved by the Council on Physical Therapy as "acceptable." These are advertised in *The Journal of the American Medical Association* and can be safely prescribed by the otologist. It remains for other less widely known ethical makers of reliable instruments to submit their aids to the Council. If these instruments prove acceptable, their makers and the public will be protected against the unscrupulous high pressure salesmen of inferior and often worthless aids.

Because of the rapidity with which improved models with appealing features are being released it is unwise on principle for an otologist to prescribe or recommend the device of only one manufacturer to the exclusion of others. The patient should be allowed the choice of several aids of different makers. Otherwise he may be dissatisfied and discredit the recommended aid, the agent and the prescribing otologist. In the last analysis the ultimate test of the efficiency of a hearing aid is the easily made intelligibility test. Every otologist should be familiar with its application. Comparative intelligibility tests of different aids must be made under identical conditions, and the person making the test should have no financial interest in the sale of any instrument.

The advent of the audiometer and the development of selective amplification have made it possible for the distributors or salesmen under the title of "consultant in hearing aids" or "audiometrist" to disturb the close relation between physician and patient. The makers of "accepted" hearing aids insist that their representatives be well trained and instruct them to limit their efforts strictly to furnishing the hearing device which will best meet the needs of each prospect. They are urged to avoid the temptation to diagnose, or to suggest the treatment of, aural diseases in violation of medical practice acts in force in all states. Nevertheless, the opportunity and temptation to violate this principle exist, endangering the patient's best interests and jeopardizing the prestige of the medical profession.

The imposing equipment of the lay "consultant," including an audiometer, a master hearing aid and a noise-proof testing booth, the interested, confidence-inspiring manner with which he does his work and his understanding of the psychology of the handicapped patient all tend to convince the latter that he is in the hands of one better qualified to solve his hearing problems than the physician or the otologist he may have consulted.

To meet this serious situation most effectively it is necessary that the otologist use equipment and render service so superior that he will not suffer by comparison with the distributor of hearing aids or the lay consultant.

The otologist in referring persons to the distributor of hearing aids should impress each patient with the fact that the use of a hearing device will not prove to be the complete solution of his hearing problem and that he should make every effort to preserve his residual hearing by keeping in close touch with an understanding, interested otologist or physician. In many cases, by close supervision of his health, much may be accomplished to arrest or retard further loss of hearing. With mastery of lip reading and acquired skill in the use of the best hearing aid which he can procure, the aurally handicapped person can long retain his contacts with his fellows and insure his economic and social security.

CONCLUSIONS

1. It is an important function of the otologist to help his aurally handicapped patient obtain the hearing instrument best suited to his individual requirements, to protect him from the exaggerated claims and high pressure methods of unscrupulous salesmen, particularly those selling inferior second hand, obsolete or worthless devices and to insure to him the privilege of choosing a hearing aid from among the accepted models of different manufacturers, provided that in their performance they meet his needs with equal effectiveness.

2. It is important that otologists be well equipped both as to their instrumentarium and as to their technical knowledge, so that the referred patient will not conclude that the hearing aid representative is better prepared to serve him than the medically trained man.

3. Otologists should encourage the makers of high grade hearing aids to submit their products to the Council on Physical Therapy of the American Medical Association for acceptance and should cooperate with them in their endeavor to distribute and service their devices according to the highest ethical standards.

OBJECTIVE MEASUREMENT OF HEARING

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NEW YORK

In 1934, while contemplating the regularity with which nystagmus is produced by stimulation of the vestibular branch of the eighth nerve, I theorized that when one part of the auditory nerve is so closely associated with the nerve of the eye it is reasonable to expect that the other part may have some similar association. This theory was easily and quickly put to the test. In 10 persons with normal hearing a sudden noise was seen to produce a movement of the pupils of the eyes. Careful analysis of this movement showed that it consisted of a distinct, rapid and consensual dilatation of the pupil. The dilatation was momentary and was quickly followed by contraction, even during the continuance of the noise.

A search of the literature revealed that a number of otologists had anticipated me with both the theory and attempts to prove it. Cemach [1] in 1919 wrote an exhaustive article on the subject and cited the work of Schurygin (1901) and Udwarkelyi (1912). According to Cemach, Udwarkelyi cited Ossino as describing oscillatory movements of the pupil occurring when a loudly sounding tuning fork was held to the ear and himself described a marked dilatation of the pupil when such a noise was produced. Schurygin, according to Cemach, described the pupillary reaction to cochlear stimulation as a distinct contraction followed by a dilatation. Schurygin, it seems, performed his tests on soldiers, to determine the state of their hearing, using tuning forks, bells, whistles, a fiddle and the human voice, and was satisfied that the reaction was constant and definite. Cemach repeated Schurygin's tests and reported that his tests did not show such regular and definite reactions as were claimed by Schurygin.

When one considers the difficulty in obtaining sounds of fixed frequencies and uniform volume and in changing frequency and volume by means of the instruments that these investigators used, it is easy to see how disagreements could arise. The desirablity of an objective test for hearing is so great, however, and the development of sound-producing and testing apparatus has advanced so greatly with the development of radio that I determined to make an independent investigation of the subject, using for this purpose a sound-producing instrument known as an audio beat frequency oscillator.

1. Cemach, A.: Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres **14**:1, 1919.

A beat frequency oscillator, several examples of which, known as audiometers, are on the market, is an instrument for developing a signal at any required frequency by the use of oscillating radio tubes. The principles of operation are briefly as follows: Two radio tubes that oscillate at, say, 50,000 frequencies are put in parallel circuits. One tube is left to oscillate at this frequency unchanged. The other tube, by means of resistances, coils and condensers, can have its frequency changed. Suppose, for example, it is made to oscillate at 50,500. The two sets of oscillations will beat against each other and a signal will be produced having the frequency of the difference, or 500. This signal, similar to the hum of a tuning fork, is picked up by a detector tube and can be amplified to be heard through ear phones or a loud speaker. The oscillator, by the use of coils of fixed characteristics, can be made to give fixed frequencies, say C, C-1, C-2, C-3 and so on, or it can, by means of a variable condenser, be changed to any frequency within its range. If its range is within the audible frequencies it is called an audio beat frequency oscillator; if above the audible frequencies, a radio beat frequency oscillator. All the instruments have power regulators so that it is possible to vary the volume of sound given off as well as its tone. All types of oscillators have a tendency to change their frequencies somewhat, or "drift," because of the heat developed and the atmospheric and other conditions, and should have a device for calibrating them frequently.

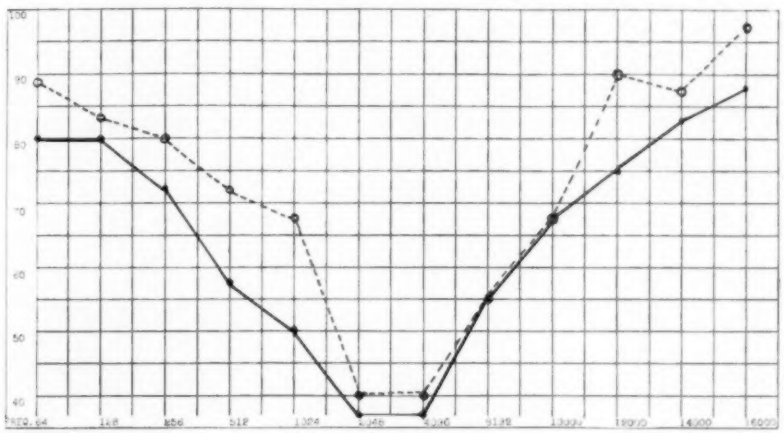
The advantages of the use of an oscillator instead of the ordinary sound-producing apparatus are obviously purity of tone, control of volume and the ability to produce or cut off the sound instantly.

I used a specially adapted audio beat frequency oscillator with a logarithmic volume control such that the dial on the volume regulator showed the decibels given off.

The audiopupillary reflex, as I have stated, is a quick dilatation of the pupil followed by an equally quick contraction, the latter occurring even during the continuance of the sound. The appreciation or failure of appreciation of this reflex depends on several factors, some on the patient's side, some on the examiner's. To begin with, the audiopupillary reflex is best seen in blue, gray or light brown eyes, in which the contrast between the pupil and the iris is sharp. A dark brown iris, nystagmus or twitching of the eyelids makes the examination difficult. The patient must be seated in a good light, with the eyes turned in such a direction that the cornea is free from reflections of the light, windows and houses. The patient is instructed to look at a distant object so as to avoid accommodation. As the examination progresses, the patient may blink his lids or shift his gaze to near objects, and the pupils will then react in accommodation. The examiner must constantly caution the patient to look into the distance. The confusion caused by the contraction of

the pupil in accommodation has been largely done away with by having the patient wear a strong convex lens during the examination. I have had Mr. Frederick Krieger, an optician in New York, make up a pair of spectacles with 40 diopter convex lenses. When the patient wears these, accommodation is overcome, and the pupil is so greatly enlarged that a change in size can be easily seen. The examiner himself must have good eyesight. If he is presbyopic, he must wear fully correcting glasses. Under the best conditions, the examination is tiring for both patient and physician, and it is often advantageously divided into two or more sessions.

Two ear phones are used, one for the patient and one for the physician. The dial of the oscillator is set for the frequency desired, with the power off. The power is then turned on slowly and the pupils



Graph of hearing recorded by objective (solid line) and by subjective (broken line) measurement.

watched carefully. When a quick dilatation is noted, the number of decibels is recorded. The test is repeated several times to rule out accommodation.

The accompanying chart is a good average record of an examination the conditions of which were right. The dot shows when the examiner noted the audiopupillary dilatation, the circle when the patient stated that the sound was heard. In some places the two coincide; in others the objective sign comes first, probably because it takes a little longer for the patient to notify the examiner that he hears than for the examiner to notice it himself.

In conclusion, I feel that, given the proper conditions, the test is remarkably accurate. It is definitely useful in the detection of malingering and should have a distinct place in the examination of military candidates or victims of accidents who claim impairment of hearing.

SURGICAL MANAGEMENT OF OTOGENOUS ABSCESS OF THE BRAIN

LEO J. ADELSTEIN, M.D.
LOS ANGELES

Since Macewen's [1] classic monograph, published in 1893, the literature concerning the diagnosis and treatment of abscess of the brain has steadily grown to occupy a position of extreme interest in clinical medicine. In spite of the great advances made in neurologic diagnosis during the past several decades the increase in knowledge of pathologic conditions and the added refinements of surgical technic, the excellent results of Macewen's pioneer efforts have not been surpassed. A review of these original protocols would indicate that many of the cardinal principles established by this old master have been largely discarded in recent years as possibly being a trifle old-fashioned for this modern age, and yet the several neurosurgical clinics reporting the largest numbers of cases of abscesses of the brain with recovery have been those using a modified Macewen technic in the management of their patients.

As Dixon [2] has aptly stated, the greatest problem in the successful management of an abscess of the brain is the diagnosis of the lesion. This seems almost trite; yet frequently the condition escapes recognition as one of the gravest complications of otitis media and mastoiditis, which, according to Lund,[3] accounts for the persistent high mortality.

In reviewing the fatal intracranial complications found in a series of 10,000 necropsies, Courville and Nielsen [4] found that 46 per cent of abscesses of the brain were directly due to otitic infections. This survey agrees fairly well with the general statistics, which indicate that approxi-

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From the Neuro-Surgical Service of Dr. Carl W. Rand, Los Angeles County Hospital, and the Department of Surgery (Neurological), University of Southern California School of Medicine.

1. Macewen, W.: Pyogenic Infective Diseases of the Brain and Spinal Cord, Meningitis, Abscess of Brain, Infective Sinus Thrombosis, Glasgow, James Maclehose & Sons, 1893.

2. Dixon, O. J.: Brain Abscess as the Otologist's Problem, J. A. M. A. **96**: 481 (Feb. 14) 1931.

3. Lund, R.: Diagnosis and Differential Diagnosis of Otogenic Brain Abscess, Acta oto-laryng. **11**:479, 1927.

4. Courville, C. B., and Nielsen, J. M.: Intracranial Complications of Otitis Media and Mastoiditis, Acta oto-laryng. **21**:19, 1934.

mately 50 per cent of all abscesses of the brain are otogenous.[5] Evans,[6] in a series of 194 abscesses of the brain, found that 83.2 per cent were due to direct extension from the middle ear and the mastoid. These figures would indicate that as a complication of otitis media abscess of the brain does not fall far behind septic meningitis or sinus thrombosis in frequency.

There is little question that abscess of the brain results from chronic otitis media much more often than it does from acute infection. The results of the investigations made by Neumann,[7] Lund,[8] Heimann [8] and others indicate that in approximately 80 per cent of cases otogenic abscess of the brain arises from chronic disease of the mastoid, and in 20 per cent, from acute otitis media. Perhaps the greatest concern and confusion arise when acute otitis has been present, with complete healing of the tympanic membrane and with little or no involvement of the mastoid, and signs and symptoms of intracranial invasion appear. The reports of Love [9] and of Faunce and Shambaugh [10] illustrate the difficulties presented by the intracranial complications of acute otitis media. Case 1 in the present series provides such an example.

PATHOGENESIS

To Körner [11] has been given the greater part of the credit for determining the relation between otitis media and abscess of the brain. He ascribed the pathologic condition to direct extension and looked on the intracranial abscess as purely adjacent. In the large majority of cases this method of invasion, through the tegmen and the meninges, is probably the route followed. However, Macewen [1] indicated fairly well the possibility of several other methods of extension which he described as (1) retrograde venous thrombosis, (2) embolic occlusion of a local artery or (3) extension by way of the perivascular spaces. Recently the conception of the invading process reaching the brain by

5. Gowers, W. R.: A Manual of Diseases of the Nervous System, Philadelphia, P. Blakiston's Son & Co., 1903, vol. 2, p. 470.

6. Evans, W.: The Pathology and Aetiology of Brain Abscess, Lancet **1**: 1231 (June 6); 1289 (June 13) 1931.

7. Neumann, H.: Der otitische Kleinhirnabszess, Leipzig, Franz Deuticke, 1907.

8. Heimann, T.: Ein Fall von akutem otitischen Schläfenlappenabszess induziert durch Otitis suppurativa acuta arteficialis: Eininges zur Statistik der otitischen Hirnabzesse, Arch. f. Ohrenh. **66**:251 (Dec. 13) 1905.

9. Love, A. A.: Complications of Otitis Media Without Rupture of the Membrana Tympani, Arch. Otolaryng. **17**:297 (March) 1933.

10. Faunce, C. B., and Shambaugh, G. E., Jr.: Abscess of the Brain Following Mild Transitory Otitis Media, Arch. Otolaryng. **17**:673 (May) 1933.

11. Körner, O.: Die otitischen Erkrankungen des Hirns, der Hirnhäute, und der Blutleiter, Munich, J. F. Bergmann, 1895.

the way of larger vascular channels has been emphasized by Courville and Nielsen,[12] who have critically analyzed the observations on a number of abscesses of the brain in atypical locations secondary to otitis media and have explained the occasional presence of an abscess in the frontal or the parietal lobe as due to extension by way of the anastomotic cerebral veins, a mode of invasion probably not often enough appreciated. Bagley,[13] in 1924, described the vascular relation which exists between the cerebrum and the tympanic cavity by emphasizing the drainage system connecting these structures, namely, the superior petrosal sinus and the regional dural veins. At any rate, the chief manner of invasion appears to be extension by contiguity through the tegmen tympani or antrums.

PATHOLOGY

The actual pathologic basis of abscess of the brain is septic encephalitis, which is more or less difficult to control and much more difficult to treat until it shows signs of becoming encapsulated. Thus, in the stage of actual invasion, with widespread encephalitis, the patient may die because of the extreme virulence of the invading organism, with subsequent failure to form a self-limiting capsule about the septic process. If the encephalitic process or cerebritis shows signs of encapsulation, the question of surgical intervention is always one of great moment, and the decision must be based on secure pathologic knowledge of the development and life history of the encapsulating process.

The investigations of Penfield,[14] Globus and Horn[15] and others indicate that an abscess of the brain tends fairly definitely to heal by capsule formation and that a definite minimum time is required for nature to complete her efforts to wall off the septic focus. During the first week of invasion, when the process is in the earliest stage, that of encephalitis or cerebritis, the beginning of capsule formation may be noted in the migration of lymphocytic elements and the proliferation of blood vessels about the infectious process. Shortly thereafter fibroblasts are formed and organized into a firm protective wall separating the

12. Courville, C. B., and Nielsen, J. M.: Pathogenesis of Otogenous Abscess of the Temporal Lobe: Preliminary Report, West. J. Surg. **43**:681 (Dec.) 1935; Otogenous Abscess of the Parietal Lobe: Review of the Literature and Report of Six Cases, Arch. Surg. **30**:930 (June) 1935. Nielsen, J. M., and Courville, C. B.: Otogenous Abscess of the Frontal Lobe: Review of the Literature and Report of Five Cases, Acta oto-laryng., 1937, supp. 21, p. 1.

13. Bagley, C.: Brain Abscess with Pathological Observations, Surg., Gynec. & Obst. **38**:1 (Jan.) 1924.

14. Penfield, W.: Principles of the Pathology of Neurosurgery, in Nelson Loose-Leaf Living Surgery, New York, Thomas Nelson & Sons, 1927, vol. 2, pp. 309-311.

15. Globus, J. H., and Horn, W. D.: Inherent Healing Properties of Abscess of the Brain, Arch. Otolaryng. **16**:603 (Nov.) 1932.

abscess from the normal brain tissue. If sufficient time is allowed, the capsule of the abscess becomes firm and dense and affords excellent protection against the spread of the purulent process. It has been clinically observed that by the end of three or four weeks the capsular wall is fairly well developed and by the fifth and sixth weeks not only is completely formed but has grown to feel tough and rubbery to the exploring needle.

Thus, as McKenzie [16] has well said, the diagnosis of an abscess of the brain does not mean that there is an acute surgical emergency. The time element must be considered and surgical intervention advised only after nature has thoroughly limited the infection. The time limits have been carefully verified clinically, particularly by Grant,[17] in whose series well encapsulated abscesses were found in all patients operated on after the sixth week. In the patients operated on during the first week or ten days little or poor attempts at walling off the process were noted, with a marked increase in the mortality. The average time for complete encapsulation appears to be from the fourth to the sixth week after intracranial invasion has started.

The majority of cerebral abscesses are subcortical, and in many instances the route of invasion to such a depth in the white matter as is commonly seen cannot be traced. In a few cases there are "stalk" indications extending from the meninges to the abscess; however, this is rather uncommon. The "stalk" of an abscess is supposedly a thrombosed vessel which has served as a point of entry for the invading organisms.

DIAGNOSIS

The symptoms and signs of abscess of the brain naturally vary with the stage of the infectious process and thus they depend largely on when the patient is examined. The patient with chronic or acute otitis media may give a history of sudden cessation of all drainage from the ear, followed by symptoms of meningeal irritation. The neck may show early rigidity; headache probably is severe, and a septic rise and fall in the temperature is usual. The pulse becomes fast, and the entire picture may easily be mistaken for that of generalized meningitis. The white blood cell count rises to 15,000 or higher, and the general appearance is that of sepsis. The spinal fluid at this time is under increased pressure and often purulent, with increased globulin content, and at times the invading organisms may be identified in it. This is the usual picture during the first week of intracranial invasion.

16. McKenzie, K. G.: The Treatment of Abscess of the Brain, Arch. Surg. **18**:1594 (April) 1929.

17. Grant, F. C.: The Mortality from Abscess of the Brain, J. A. M. A. **99**: 550 (Aug. 13) 1932.

If immunity to this severe infection begins to develop, the generalized meningeal irritation slowly subsides, and the results of repeated examinations of the spinal fluid are an excellent index of the subsequent progress of encapsulation. In an important paper on this aspect of the problem Woltman [18] clearly showed that a gradual reduction in the cell count of the spinal fluid may be looked on as an important criterion of the progress of capsule formation.

With the limiting membrane about the septic focus in the brain well developed, the temperature gradually returns to normal or subnormal; the pulse becomes slow, and the nuchal rigidity subsides. During this stage the increased intracranial tension causes the patient to become drowsy and apathetic, with loss of appetite. Rapid wasting of the muscular tissues is frequently seen. Headache and vomiting are common and usually persist. The fundi may reveal choking of the optic disks, although this is not as common as might be expected. Since abscess of the brain largely replaces rather than displaces cerebral tissue, the optic disks many times do not reveal any characteristic changes. Coleman,[19] with 28 cases, noted changes in the optic disks in only 16, and his impression was that choked disks occur in cases of abscess of the brain with approximately the same frequency as in cases of cerebral tumor. Lillie [20] attempted to correlate the stage of papill-edema with the optimum time for surgical intervention. With increasing edema of the optic nerve heads, intervention is to be withheld, as the encephalitic process is still active. When the swelling of the disks becomes stationary, the process of encapsulation is complete. It has been difficult to apply this valuable observation in the majority of cases observed in the clinic of the Los Angeles County Hospital, since many of the patients have presented no appreciable changes in the optic disks.[21] Examinations of the visual fields are of importance, and measurements should always be made, provided the patient is able to cooperate. Since many of the patients are semicomatose, it is often extremely difficult to carry out this exact procedure.

It has been estimated by various observers [22] that abscess secondary to disease of the mastoid is located in the adjacent temporal lobe or in the cerebellum in the ratio of approximately 3 to 1. The statistics

18. Woltman, H. W.: Spinal Fluid Cell Count and Encapsulation of Brain Abscess: An Attempt to Correlate These Factors and to Determine the Optimal Time for Drainage, J. A. M. A. **100**:720 (March 11) 1933.

19. Coleman, C. C.: Brain Abscess: A Review of Twenty-Eight Cases with Comment on the Ophthalmologic Observations, J. A. M. A. **95**:568 (Aug. 23) 1930.

20. Lillie, W. I.: The Clinical Significance of Choked Discs Produced by Abscess of the Brain, Surg., Gynec. & Obst. **47**:405 (Sept.) 1928.

21. Eagleton, W. P.: Brain Abscess, New York, The Macmillan Company, 1922.

22. Neumann.[7] Heimann.[8]

at the Los Angeles County Hospital have revealed a ratio of about 2 to 1. In general fully two thirds of all otogenous abscesses are found in the temporal lobe.

Abscess of the temporal lobe, as it gradually becomes encapsulated, shows significant localizing signs. Extraocular palsies, defects of the visual fields, with homonymous hemianopia, and muscular weakness on the contralateral side of the body, with pathologic reflexes, are important findings and often are elicited only after repeated neurologic examinations.

Cerebellar abscess is usually distinguished by nystagmus and marked ataxia, with homolateral muscular weakness and pathologic reflexes. The neuro-otologic examination will often indicate also complete involvement of the labyrinth on the affected side.

It must not be forgotten that occasionally an otitic infection may give rise to abscess situated atypically in the frontal or in the parietal area. If the parietal lobe is the locus of infection, irritative motor phenomena are seen, with unilateral jacksonian seizures. Conjugate deviation of the head and eyes [23] is an important sign, particularly after motor paralysis has developed, at which time the deviation is toward the side of the lesion. The degree of contralateral muscular weakness is never so great as in the involvement of the parietal lobe, when complete hemiplegia is the rule, with marked sensory disturbances. Astereognosis is a common finding.

With invasion of the frontal lobe, mental symptoms may be prominent, and if the lesion is on the major side motor aphasia is noted. The changes in personality may be extreme. Reflex grasping and groping are significant findings. Jacksonian epilepsy and spasticity of the contralateral reflexes are observed in some cases. In all doubtful conditions, ventriculography is indicated to help localize the abscess.

SURGICAL ASPECTS

In the words of Adson and Craig,[24] whose experiences echo the results of other neurosurgeons, "It took us many years to learn that hasty emergency operations were futile and were accompanied by high mortality." It is now generally acknowledged that abscess of the brain is not a surgical emergency and that the extremely high mortality of earlier days was due to the practice of intervening surgically as soon as a diagnosis of abscess was made. Thus the experience of Grant, as indicated previously, revealed that of 19 patients with abscess of

23. Meyers, I. L.: Conjugate Deviation of the Head and Eyes: Its Value in the Diagnosis and Localization of Abscess of the Brain, Arch. Otolaryng. **13**:683 (May) 1931.

24. Adson, A. W., and Craig, W. M.: Surgical Management of Brain Abscess, Ann. Surg. **101**:7 (Jan.) 1935.

the brain operated on before encapsulation was complete, not a patient recovered. All these 19 patients were subjected to operation within six weeks after the initial cerebral involvement. This particular part of the problem has been rather well settled to the effect that operation before complete encapsulation has taken place is distinctly dangerous. Rarely is early intervention necessary.

The technic of surgical management, including drainage and its adequate maintenance, has never been standardized. Almost as many methods of drainage have been proposed as there have been operators —a divergence induced no doubt by the variable mortality among those operated on by the individual surgeons.

Macewen's original method of intervention was no doubt born of a necessity which required the surgeon to be not only an ingenious operator but a shrewd clinician as well. The principles of this early method now appear to be so fundamental that their review is indicated. More than frequently Macewen approached a cerebral abscess through as clean an area as he could find, many times forsaking the mastoid wound and draining the abscess through a new opening, a procedure which even today is looked on askance by a number of otologists. After careful localization and encapsulation, the abscess was drained through a small opening with a soft drainage material (decalcified chicken bone), which was allowed to remain undisturbed. The end results were almost uniformly excellent. In fact, Macewen was led to believe by his experience that abscess of the brain is one of the most favorable of cerebral lesions to treat and cure. His optimism was founded not only on facts which have stood the test of time but on results which have not been surpassed to date.

In 1915, Mosher [25] introduced a modification of a drain which had been used successfully in the treatment of suppurative infections of the brain in the British army during the World War. His technic included generous exposure of dura over the site of the abscess, location of the capsule by needling, removal of a cone of dura, underlying brain and abscess wall, and insertion of the wire gauze drain. This method has been widely advocated by a number of Mosher's pupils, notably Cahill,[26] in whose hands the results have been excellent. Recently 5 consecutive recoveries following the use of the Mosher drain in the treatment of abscess of the brain have been reported by Kaplan,[27] whose

25. Mosher, H. P.: The Wire Gauze Brain Drain, Surg., Gynec. & Obst. **23**: 740 (Dec.) 1916.

26. Cahill, H. P.: Twelve Cases of Cerebral and Cerebellar Abscesses Drained by the Mosher Wire Gauze Cone, Tr. Am. Otol. Soc. **17**:42, 1925.

27. Kaplan, A.: Abscess of the Brain: Report of Five Consecutive Recoveries with Special Reference to the Mosher Drain, Arch. Otolaryng. **21**:385 (April) 1935.

ability as a careful neurologic observer no doubt contributed a good deal to his success.

With the appearance of Eagleton's [21] monograph in 1922, the osteoplastic flap method of approach in the treatment of abscess of the brain received an impetus, and no doubt it still has a number of adherents. It has been difficult to obtain a reasonably accurate survey of the mortality following this method of treatment; however, the rate appears to be high, in the neighborhood of 75 per cent. The technic appears to be extremely radical and to favor widespread dissemination of infective material in the subarachnoid spaces, with a good deal of traumatic encephalitis. It appears to be a rather strenuous method to impose on an already sick patient.

In 1924 King [28] recommended the so-called unroofing of the abscess cavity, allowing temporary herniation, a technic which has had many adherents and the results of which "have been fairly good." The exact mortality for this method has been difficult to estimate. Kahn,[29] in a recent publication, stated that, using a modified King technic, he has encouraged the deep encapsulated type of abscess to migrate toward the cortex before drainage by allowing preliminary herniation of the brain through a trephine opening about the size of a silver dollar. After several days' waiting, the abscess cavity is opened and drained and even allowed to extrude itself. Dowman [30] advocated a two stage operation of this nature primarily to allow adhesions to form between the dura and the cortex. In this way he attempted to seal off the subarachnoid space against contamination and possible meningitis. Kahn modified the original King technic, apparently, because of the high percentage of epilepsy following this method of drainage.

Horrax [31] further modified the method by cutting off the dome of the abscess and suturing the walls to the subcutaneous tissues. Spurling [32] has used a similar method.

Adson and Craig,[24] with another modification, seal the adjacent meninges and cortex with the electrocautery, locate the abscess cavity with a cannula, aspirate the pus with a syringe, wash out the cavity with saline solution and drain the abscess with rubber catheters held

28. King, J. E. J.: The Treatment of Brain Abscess by Unroofing and Temporary Herniation of Abscess Cavity with the Avoidance of Usual Drainage Methods, Surg., Gynec. & Obst. **39**:554 (Nov.) 1924.

29. Kahn, E. A.: The Treatment of Encapsulated Brain Abscess, J. A. M. A. **108**:87 (Jan. 9) 1937.

30. Dowman, C. E.: The Treatment of Brain Abscess by the Induction of Protective Adhesions Between the Brain Cortex and the Dura Before the Establishment of Drainage, Arch. Surg. **6**:747 (May) 1923.

31. Horrax, G.: A Method for the Treatment of Certain Chronic Encapsulated Brain Abscesses, S. Clin. North America **14**:1179 (Oct.) 1934.

32. Spurling, R. S., in discussion on Kahn.[29]

in place with iodoform gauze packing. Drainage is maintained from four to six weeks.

In 1926 a sudden trend toward more conservative methods of treatment was noted, perhaps induced by the persistently high mortality. Dandy,[33] in a discussion of the prevailing methods of treatment, suggested simple tapping of chronic abscesses as a peculiarly easy and efficient type of intervention. His reasons indicate that trauma incidental to placing the gauze drain and other materials tends to increase the intracranial pressure materially, with formation of a brain fungus, which in itself is a problem of no small proportions. The suggestion of this simple method, tapping, no doubt caused a swing of the pendulum back to more conservative methods, with decreasing mortality. Grant [34] stated that he had 5 of 7 patients with encapsulated abscess recover after simple tapping. Sachs [35] has had 3 patients recover after this method of treatment. Vincent,[36] using a similar method, taps the abscess repeatedly and finally extirpates it as he would a tumor. He stated the belief that repeated simple tapping keeps the intracranial tension within normal limits while the capsule of the abscess becomes extremely thick and fibrous. When the abscess has aged sufficiently, he removes the entire mass. Vincent's results have been so impressive that several surgeons in this country, particularly Bailey,[37] have recently been treating abscesses in this manner. Puech, Eliades and Askenasy [38] have recently reported on 8 patients treated by this method.

In 1929 a conservative method of treatment, closely following Macewen's outline, was described by Coleman,[39] whose results are acknowledged to be among the best in this country to date. His method includes exact localization; a small trephine opening is placed as centrally as possible over the site of the abscess; a small nick is made in the dura, and a soft rubber catheter is inserted promptly and with care into the abscess cavity with a minimum of trauma. The catheter is allowed to remain in place as long as necessary, which is indicated by extrusion of the drain by the healing process. The statistics reported

33. Dandy, W. E.: Treatment of Chronic Abscess of the Brain by Tapping, J. A. M. A. **87**:1477 (Oct. 30) 1926.

34. Grant, F. C., in discussion on Kahn.[29]

35. Sachs, E., in discussion on Coleman.[39]

36. Vincent, C.: Sur une méthode de traitement des abcès subaigus des hémisphères cérébraux: Large décompression, puis ablation en masse sans drainage, Gaz. méd. de France **43**:93 (Feb. 1) 1936.

37. Bailey, P., in discussion on Kahn.[29]

38. Puech, P.; Eliades, C., and Askenasy, A.: Les abcès du cerveau, Ann. de thérap. biol. **9**:35 (June-July) 1935.

39. Coleman, C. C.: The Treatment of Abscess of the Brain, Arch. Surg. **18**: 100 (Jan., pt. 1) 1929.

by Coleman reveal that treatment by this method in 28 cases resulted in 19 recoveries.

Grant's method, introduction of a small rubber catheter into the abscess cavity with a minimum of trauma through a cannula with a closely fitting metallic sleeve, is an ingenious simplification of the technic of drainage and in his hands has proved excellent. For 22 of the 30 encapsulated abscesses thus treated he used a two stage operation, allowing sufficient time after the trephine opening was made for the production of meningocortical adhesions with walling off of the subarachnoid space. In the 30 cases there were 20 recoveries, a proportion which speaks well for the method.

The technic used at the clinic of the Los Angeles County Hospital has been uniformly conservative: The abscess is localized by careful neurologic study; encapsulation is always patiently awaited, the patient receiving supportive treatment during the encephalitic stage, for at least four weeks after the initial cerebral involvement. A small trephine opening is centered as closely as possible over the site of the abscess and its bony margins carefully sealed with bone wax to close off the diploic spaces and prevent contamination. A nick is made in the dura just large enough to allow the passage of the exploring cannula and drain. The drainage material used in the majority of cases has been a one eye soft rubber catheter, on the average about size 16. The abscess capsule is discovered by careful needling with a blunt brain cannula. The pus is not allowed to gush out and contaminate the field but is restrained by keeping the stylet in position. The soft rubber catheter is measured off to a correct length and carefully inserted into the cavity of the abscess with a minimum of trauma. With the drain in position, the contents of the abscess are allowed to flow gently into an aspirator and little or no contamination of the wound takes place. The rubber catheter is then meticulously sutured to the edges of the dural incision, the fascia and the cutaneous edges of the wound. These silk sutures are carefully placed in the "submucous layer" of the drain so as to avoid entering the lumen of the catheter. This part of the technic must be rigidly observed to prevent contamination of the edges of the wound and the subarachnoid spaces. The drain is further secured by a safety pin bound down to the adjacent scalp with adhesive tape. Thus securely anchored it cannot be dislodged by the intracranial tension. No drain has been lost or dislodged with this method. Finally a generous loose dressing is applied.

By restraining the immediate flow of the contents of the abscess in the manner described, one can avoid collapse of the walls of the cavity, thus preventing any tendency to multiloculation. The incision in the scalp and the trephine opening are made in a clean area entirely apart from the mastoid wound. This is done deliberately to avoid

searching for the abscess through an infected area, since contamination of the brain is unavoidable if one passes a brain cannula through a draining mastoid incision. Thus a potentially clean wound is preserved, and if no abscess is located the damage is minimal, and no further encephalitis is initiated. This must always be kept uppermost in mind, not only for the preservation of sound surgical principles but also because there may be no true abscess but a "pseudoabscess,"[40] clinically difficult to differentiate from a true abscess. Needling a "pseudoabscess" will cause no great harm, provided the approach has been kept sterile. If contamination of a clean brain is induced by exploration through an infected mastoid wound, the damage may be irreparable.

The drain is allowed to remain undisturbed as long as necessary. The wound is dressed daily and the drain shortened as the healing process causes the catheter to extrude. The abscess cavity is not washed or irrigated, and the drain is not manipulated under any circumstances, unless there is an apparent obstruction. The average period of drainage has been observed to be over six weeks, and in some cases it lasts as long as three months.

In several cases a goose quill [41] has been substituted for the rubber catheter with equally good results, the remainder of the technic remaining unchanged.

During the past two years a semirigid drainage tube [42] has been used with success in 7 cases. The inside lumen of this tube is six times the diameter of an 18-F catheter and fits closely over the brain cannula. The cannula and tube are introduced together at the time of exploration, the abscess is discovered and tapped, and the cannula is then removed, the drainage tube being left in correct position, all in one maneuver; thus the number of needling efforts is reduced to a minimum and contamination prevented. The cerebellar abscess reported in this series was treated in this fashion, with an excellent result.

The cases presented in this series represent a cross section of the experiences of the several surgeons in this clinic in the use of similar conservative methods of treatment.

REPORT OF CASES

CASE 1.—*Acute otitis media on the left, of six days' duration, with apparent complete recovery, was followed ten days later by an injury to the head with*

40. Adson, A. W.: Pseudo-Brain Abscess, S. Clin. North America **4**:503 (April) 1924. Nielsen, J. M., and Courville, C. B.: Pseudo-Abscess of the Brain: I. Intracranial Disease During Otitis Media Simulating Encephalic Abscess, Ann. Otol., Rhin. & Laryng. **43**:972 (Dec.) 1934.

41. Raney, R. B.: A Clinic on Abscess of the Brain, Bull. Los Angeles Neurol. Soc. **1**:119 (Sept.) 1936.

42. Seletz, E.: One-Step Technique for Draining Brain Abscess, Am. J. Surg. **35**:619 (March) 1937.

subsequent headache, vomiting, chills, hemiparesis and coma. Drainage of an abscess of the left temporal lobe with a small rubber catheter brought about complete recovery.

On March 1, 1932, W. O., an 8 year old white school boy, was admitted to the Los Angeles County Hospital in coma. He was accompanied by his parents, who gave the following history: The boy had been perfectly well in every way until Jan. 16, 1932, when he first complained of a severe earache on the left. This was followed by drainage from the ear for two days. Complete healing took place, and the child returned to school four days later with no complaints. A few days after returning to his classes he was knocked down by a playmate, the left side of his head striking a sidewalk. There was no external evidence of any injury, and there were no symptoms. On February 9 the boy was brought home from school at 11 a. m., after a severe spell of nausea and vomiting. At that time it was noted that he was unable to keep his balance. He complained for the first time also of a tingling sensation beginning in the tips of the fingers of the left hand and extending up to the left side of the head. He felt well enough the next day to return to school and three days later was again brought home after an attack of nausea and vomiting. He was kept in bed, and the family physician was called. At this time difficulty in completing sentences was noted, and after attempting to make a statement the boy would complain of being unable to think. There was also severe pain in the left side of the head. During the following several days periods of drowsiness were noted, lasting for three or four hours at a time, between which the boy would be perfectly wide awake and apparently clear. On February 26 he became drowsy, vomited and went to sleep. The next day he felt better. On February 28 he awoke screaming with pain in the head and pulled his hair. On March 1, the day of admission to the hospital, he vomited again and seemed to be more alert mentally. At 11 a. m. his eyes became set; the hands were clenched and the arms flexed, and the mother noticed that the left pupil was dilated. The child rapidly became deeply comatose, remaining so on admission to the ward. The day before entrance to the hospital he had complained of a severe chill and requested an electric heater for comfort.

Examination revealed a completely comatose patient. The pulse rate was 54, and the rectal temperature was 98.8 F. The positive findings were: (1) a recently healed left ear drum, (2) severe bilateral choking of the optic disks, more marked on the left side, (3) bilateral spastic reflexes with Babinski's sign on the right and (4) slight reduction in muscular power on the right side of the body, although the last could not be definitely determined.

The leukocyte count was 20,200, with 86 per cent neutrophils. The erythrocyte count was 5,450,000, with 85 per cent hemoglobin. The urine was normal. Roentgenograms revealed no involvement of the mastoid on either side.

Operation was performed approximately three hours after admission to the hospital. An incision about 3 inches (8 cm.) long was made in the left temporal region, and a small trephine opening was prepared just above the upper pole of the ear. The trephine opening was enlarged to the size of a twenty-five cent piece. The dura was found to be under extreme tension, and an incision approximately 0.5 cm. in length was made in this membrane. A ventricle needle was carefully introduced into the left temporal lobe, and a large abscess was encountered at a depth of 5 cm. The contents of the abscess cavity were carefully restrained from gushing out by replacing the stylet within the needle. A size 16 soft rubber one eye catheter was measured off to a length of 7 cm. and carefully inserted within the abscess cavity and the purulent contents allowed to drain gently into a suction apparatus.

The drainage tube was then carefully anchored with three silk sutures to the dura, two sutures to the muscle and fascial layers and two sutures to the skin. At the end of the operation the contents of the tube were found to be pulsating, and drainage was free and adequate. The patient's condition at the end of the operation was fair. The entire procedure was carried out with the patient under local anesthesia, 1 per cent solution of procaine hydrochloride being used for infiltration of the scalp. The patient roused so rapidly after drainage that it became necessary to supplement the anesthetic with a small amount of ether given by inhalation in order to complete the closure of the wound.

The postoperative course was remarkably smooth. The drain was extruded on May 16, six weeks after the operation. The boy was discharged to his home on May 24 in good condition, with no complaints.

In September he returned to his classes in school and has remained in good health.

Comment.—This case illustrates the definite role that acute otitis media may play in the production of an abscess of the brain. The danger lies in the fact that the process is most insidious. The patient may be seen exhibiting all the cardinal signs and symptoms of increased intracranial pressure at a time when both ear drums are healed and clean, with no involvement of the mastoid. In this particular instance the history was complicated by the addition of an injury to the head the exact significance of which was rather difficult to estimate. The recent papers of Love and of Faunce and Shambaugh present other cases illustrating this type and call attention to the vigilance that must be practiced at all times in examining children with acute otitis media.

CASE 2.—*Acute exacerbation of chronic otitis media on the right of eleven years' duration was accompanied by palsy of the right facial nerve; mastoidectomy revealed destruction of the tegmen. Subsequent severe meningeal reaction was followed by headache, vomiting, drowsiness, nystagmus and coma. Drainage of a large cerebellar abscess on the right with a semirigid catheter brought about complete recovery.*

On Oct. 29, 1935, R. O., a high school boy aged 17, was admitted to the Los Angeles County Hospital complaining of severe pain in the right ear, with complete paralysis of the right side of the face of three days' duration. Since the age of 6 years he had had a chronic purulent discharge from the right ear.

Two weeks before admission to the hospital severe pain developed behind the right ear, with almost constant generalized headache. Three days before entrance to the hospital complete palsy of the right facial nerve developed. On admission the boy appeared to be ill but alert and mentally clear. There was a profuse purulent discharge from the right ear with marked tenderness over the mastoid region. Roentgenograms revealed an advanced sclerosing process of the right mastoid. The white blood cell count was 19,400, with 88 per cent neutrophils.

On October 30 a radical mastoidectomy was performed on the right by Dr. Homer Walker, revealing an acute process superimposed on old chronic mastoiditis, with destruction of the tegmen.

The next day the boy appeared to be suffering with a severe meningeal reaction. There was marked nuchal rigidity with bilateral Brudzinski signs. An examination of the spinal fluid revealed a pressure of 350 mm. of water, with 600 lymphocytes

per cubic millimeter. The Queckenstedt test revealed no abnormal changes in pressure, and no organisms were found. The headache became extremely severe, and nausea and vomiting were constant. It was noted at this time that the palsy of the right facial nerve was gradually clearing up. The severe meningeal reaction slowly began to subside, and on November 15 the patient complained of increased headache. He appeared to be ill, and there was marked drowsiness. The retinal vessels appeared to be somewhat overfilled. Two days later the boy suddenly became comatose. The pulse rate was 68; the temperature was 97 F. by rectum. The positive neurologic findings at that time were spontaneous nystagmus in all directions, mild changes in pressure in both optic disks, diminished reflexes on the right side and apparent marked hypotonus of the right arm and leg.

Operation was performed the afternoon of November 17, nineteen days after admission to the hospital. With the patient in the cerebellar position, a horseshoe-shaped incision was made over the right cerebellar region and the suboccipital muscles carefully retracted from the floor of the posterior fossa. A trephine opening was then made in the bony floor on the right side and the defect enlarged to the size of a twenty-five cent piece. The dura was found to be under markedly increased tension. A small incision about 0.5 cm. in length was made in the dura, and the cerebellar cortex began to pout immediately. A ventricle needle covered with a semirigid drainage tube was then introduced into the right cerebellar lobe, and at a depth of 2.5 cm. a firm elastic capsule was felt. The ventricle needle and drain were then passed into the cavity of a large abscess, from which a generous amount of purulent material immediately poured forth. The ventricle needle was withdrawn, the drainage tube being allowed to remain in correct position within the cavity of the abscess capsule. The tube was sutured to the adjacent muscle, fascia and skin. At the end of the operation the drainage tube was full of pus and was pulsating. The condition of the patient at the end of the operation was fair. The entire procedure was carried out with the patient under local anesthesia induced by using 1 per cent solution of procaine hydrochloride for infiltration of the scalp and muscle. The postoperative course was remarkable for the small amount of drainage following the initial tapping of the abscess. The drain was removed on Jan. 20, 1936, and the patient was discharged to his home on January 24, at which time he was out of bed, with no complaints.

This patient has since returned to school and has remained in good health.

Comment.—It would be hard to anticipate a more satisfactory result in a case of cerebellar abscess, and it is my impression that the recovery in this case is in some measure due to the conservative management. The abscess was carefully localized, encapsulation awaited and drainage instituted with a minimum of trauma and adequately maintained for eight weeks. The management of a cerebellar abscess at best is difficult, and the mortality has been persistently high. The various methods of treatment described in detail by Friesner and Braun [43] have all been fairly consistent in the attempt to drain the abscess through the mastoid wound. The only other approach mentioned has been through the occipital bone after a wide exposure of the cerebellum. The several methods described in this monograph have been consistently followed

43. Friesner, I., and Braun, A.: Cerebellar Abscess, New York, Paul B. Hoeber, 1916.

by a number of otologists. In this clinic cerebellar abscesses have been uniformly treated by conservative methods, with a mortality of approximately 20 per cent.

CASE 3.—*Chronic bilateral otitis media had been present since childhood. Acute exacerbation on the left was accompanied by headache and vomiting; mastoidectomy disclosed extensive erosion, with epidural abscess. Subsequent symptoms were headache, chills, a septic temperature curve, meningeal reaction and suspicious left-sided subarachnoid spinal fluid block. A secondary operation revealed thrombosis of the lateral sinus; the jugular vein was ligated and the left lateral sinus opened and drained. Subsequent symptoms were headache, drowsiness, aphasia, choked disks and coma. Drainage of a large abscess of the left temporal lobe with a soft rubber catheter brought about complete recovery.*

On Oct. 26, 1934, A. E., a white man aged 22, a clerk, was admitted to the hospital complaining of headache and vomiting. Since childhood he had suffered with chronic bilateral otitis media; ten days before admission he was operated on in another hospital, at which time mastoidectomy on the left revealed extensive erosion, with a large epidural abscess. The relief of symptoms lasted several days, only to be followed by a return of severe headache, with frequent chills. Just before reaching the Los Angeles County Hospital the patient became delirious, and the temperature was noted to be 103 F. On admission he was confused and wildly delirious. The positive findings included a draining mastoid wound on the left, mild nuchal rigidity and a suggestive Babinski sign on the right; the fundi revealed early bilateral choking of the optic disks. The temperature curve was distinctly septic.

The leukocyte count was 8,300, with 80 per cent neutrophils. The spinal fluid was under 400 mm. of pressure and contained 15 lymphocytes. No organisms were found. Studies of the pressure indicated a subarachnoid block on the left side, with little or no rise in the manometer on compression of the left jugular vein.

On the night of admission to the hospital Dr. Homer Walker ligated the left internal jugular vein and drained the left lateral sinus, which was found to contain a large clot.

After this procedure the temperature came down to normal; however, the patient remained mentally dull and apathetic and two days later revealed a pronounced anomial type of aphasia. He gradually became stuporous and on November 2, six days after admission to the hospital, passed into coma. The optic disks showed increased elevation of the nerve heads, and the right side of the body seemed to be weak, with a constant Babinski sign. On November 3 the pulse was 60, the temperature was 98 F., and the clinical picture was that of severe intracranial tension. The patient was in deep coma.

Operation was performed that afternoon. A vertical incision 5 cm. in length was made in the left temporal region, and a small bony defect was prepared. The edges of this defect were carefully sealed with bone wax to close the diploic spaces. The dura was under extreme tension and white. An incision 1 cm. in length was made in the dura, and a ventricle needle was gently introduced; at a depth of 4 cm. a large abscess was discovered and tapped. The stylet was replaced to restrain the pus from gushing out. A size 16 soft rubber catheter was carefully placed in the abscess cavity and anchored with silk sutures to the edges of the dural incision, the muscle, the fascia and the skin. At the end of the operation the tube was full of purulent material and was pulsating. The condition of the patient at the end of the operation was considered poor. The entire pro-

cedure was carried out with the patient under anesthesia induced by using 1 per cent solution of procaine hydrochloride for infiltration of the scalp.

The postoperative course was stormy for the first week and then was remarkably smooth. The drain was extruded on Feb. 10, 1935, and the patient was discharged to his home on February 14.

Comment.—This patient presented in textbook fashion a rather complete picture of all the possible intracranial complications of otitis media, with the exception of severe generalized meningitis. The fortunate outcome in this case is in no small measure due to the close cooperation of the otologists and neurosurgeons concerned with the boy's care. Dr. John Osburn performed the mastoidectomy. Dr. Carl W. Rand diagnosed the epidural abscess and suggested further drainage. Dr. Homer Walker ligated the left internal jugular vein and treated the thrombosis of the lateral sinus. Dr. John Bullis observed the patient during the period of his severe meningeal reaction which proved to be also the period of encapsulation. I examined the boy and drained the cerebral abscess in the left temporal lobe.

SUMMARY AND CONCLUSIONS

Three cases of otogenous abscess of the brain with recovery following conservative management are reported.

Two of the patients had abscess of the temporal lobe. One patient had abscess of the cerebellum. In all 3 cases the abscess was secondary to otitis media and mastoiditis. All the patients have been able to return to their former activities and have remained symptom free.

The necessity for careful neurologic study is emphasized, since localization plays the most important role in successful supervision.

The principles and the process of abscess encapsulation are discussed, with reference to the axiom that abscess of the brain is not an acute surgical emergency.

The optimum time for surgical intervention appears to be from four to six weeks after initial cerebral involvement.

The prevailing methods of drainage are discussed.

The highest percentage of recoveries has followed drainage by simple methods by which excessive trauma and spread of the infection are avoided.[44] With a correctly centered trephine opening, a small dural incision, accurate and immediate location of the abscess and adequate and prolonged drainage, the formidable picture of cerebral herniation, cerebrospinal fluid fistula, with possible infection, and brain fungus is eliminated.

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44. Frazier, C. H.: How Shall We Treat Brain Abscesses? Surg., Gynec. & Obst. **57**:123 (July) 1933.

ANATOMY OF THE OPENING OF THE MAXILLARY SINUS

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In a report [1] of an earlier study of a small group of maxillary sinuses it was pointed out that what is called the maxillary ostium or orifice is usually a canal.

The present report deals with a study of 102 antrums from cadavers, including the first group, just mentioned, and is concerned with two problems: (1) Is the so-called natural ostium of the maxillary sinus an orifice (window, ostium) or a canal? (2) What are the various types of ostiums or canals found in the maxillary sinus?

PROBLEM ONE

The procedure for deciding whether the opening from the infundibulum ethmoidale into the maxillary sinus was an ostium or a canal was as follows: The middle turbinate was displaced or cut away so as to expose the middle meatus. Next, the anterior or facial wall of the antrum was removed, so as to expose the interior of the antrum. Then, with a soft, flexible probe, the distance from the uncinate border to the internal margin (i. e., within the maxillary sinus proper) of all the "ostiums" was measured. The uncinate process then was removed, and the distance from the lateral wall or floor of the infundibulum ethmoidale to the internal ostial margin was recorded. This last measurement was to determine whether the opening was a canal or an ostium. The mediolateral extent of all accessory openings was then measured. Frequently one side of a passage was longer than its opposing wall; in these instances the mean of the two distances was taken as the length of the passage.

The opening of the maxillary sinus into the infundibulum is called the ostium maxillare. Dorland's "American Illustrated Medical Dictionary" (edition 18) defines an ostium as:

> A mouth or orifice. . . . **o. arterio'sum** [B N A], arterial orifice; the opening from the ventricle of the heart into the aorta (aortic orifice) or the pulmonary artery (pulmonary orifice). . . . **o. pharyn'geum tu'bae auditi'vae** [B N A], the nasopharyngeal end of a eustachian tube. . . .

1. Simon, E.: Antroscopy and Its Relation to the Anatomy of the Maxillary Sinus, Ann. Otol., Rhin. & Laryng. **42**:198 (March) 1933.

In brief, the term ostium is synonymous with mouth or orifice and means an opening with only two dimensions, which lie in one plane; there is no third dimension.

One of the early studies and probably the basis for many descriptions of the accessory nasal sinuses was that of Zuckerkandl.[2] The following is a translation of his description of the maxillary ostium:

> . . . the ostium maxillare rests under the orbital floor, lying before the prominentia lacrimalis, varying to some extent in respect to size and form. The commonest shape is an elliptic slit, with its long axis directed sagittally; in many cases, however, it is almost circular or, through compression of one border, almost kidney shaped.
>
> The smallest opening which I met in the great number of cases was roundly formed and had a diameter of 3 mm.; the largest covered a length of 19 mm. and a width of 5 mm. Between these two extremes are to be found examples varying in length between 7 and 11 mm. and in width between 2 and 6 mm. At times the ostium is divided by a band of mucous membrane into two parts.

From this description it is plain that he considered the opening as a window or orifice having only two dimensions, namely, length and width in the sagittal plane. He did not mention a mediolateral dimension, or depth, to the openings.

A. Logan Turner,[3] in his text, wrote of the maxillary ostium:

> The size of the opening varies; it may measure only 2 by 3 mm., or it may have an antero-posterior diameter of 18 mm. When it reaches a considerable size, it may almost entirely replace the outer wall of the infundibulum, and form a slit-like communication between the antrum and that channel.

He also discussed the opening merely as an ostium with no thickness or depth.

J. Parsons Schaeffer,[4] in his thorough, detailed study on the accessory sinuses wrote:

> The maxillary ostium may be round, but as a rule is either oval or elliptical. In a series of 110 cases examined by the writer it had a great range of dimensions, varying from 1 to 22 mm. in length and from 1 to 6 mm. in width. In cases where the ostium reaches considerable size it may entirely replace the lateral wall or floor of the infundibulum ethmoidale, thus forming a long slit-like communication between the maxillary sinus and the infundibulum ethmoidale.

Again the ostium, or orifice, is described only in terms of length and width.

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2. Zuckerkandl, E.: Normale und pathologische Anatomie der Nasenhöhle und ihrer pneumatischen Anhäng, Vienna, Wilhelm Braumüller, 1882, pp. 134-135.

3. Turner, A. L.: The Accessory Sinuses of the Nose, New York, Longmans, Green & Co., 1902, p. 43.

4. Schaeffer, J. P.: The Nose, Paranasal Sinuses, Naso-Lacrimal Passageways, and Olfactory Organ in Man: A Genetic Developmental, and Anatomico-Physiological Consideration, Philadelphia, P. Blakiston's Son & Co., 1920, pp. 125-129.

Warren Davis,[5] in his text, wrote:

> The ostium varies from a narrow, slit-like opening to forms oblong or ovoid in outline. The average diameters of the ostia, as found in cases of different ages, are given in the above table of measurements of the sinus maxillares.

The measurements in this table are only in two directions and do not have a third dimension.

Hajek[6] described the opening as follows:

> The form and size of the ostium maxillare vary. It usually forms an elliptical cleft with its long axis directed sagittally. It is rarely circular or kidney-shaped. The size varies from an opening three millimeters in diameter to an opening nineteen millimeters in length and six millimeters in width. When the opening is greatly elongated the whole hiatus semilunaris may open into the antrum.

Skillern,[7] in his text, called the opening an ostium; however, he gave the impression that it is a passage or canal and wrote of the opening:

> It may assume one of several forms: round, oval, kidney shaped, or in the nature of a long slit; the oval form, however, predominates. The size varies from 2 mm. to 1.7 cm. by 1.1 cm., the average ranging from the size of a buckshot to that of a pea. This opening [ostium maxillare] is not situated as a window in a wall communicating directly from within outward, but takes a distinct direction upward, backward, and inward. From the nasal aspect the direction is naturally downward, forward, and outward.

In this group of 102 antrums there were 110 natural ostiums leading into the antrum. The average length for these 110 openings from the floor or lateral wall of the infundibulum to the internal margin of the opening in the antrum was 5.55 mm. In other words, the average of 110 natural openings measured 5.55 mm. in the mediolateral direction. These so-called ostiums have a third dimension and are actually canals, not simply ostiums, or orifices. The shortest dimension in the mediolateral direction for openings in this group was 1 mm., as in specimens 8L, 15R, 20R and others. The specimen with the longest mediolateral course was 35R, with 15.5 mm.; 27R measured 14.5 mm. In order to differentiate an ostium from a canal, an arbitrary length of 3 mm. or more in the mediolateral dimension was put as the criterion for a canal, while an opening less than 3 mm. in this axis was called an ostium, or orifice. With this length as a criterion, of 110 natural

5. Davis, W. B.: Development and Anatomy of Nasal Accessory Sinuses in Man, Philadelphia, W. B. Saunders Company, 1914, pp. 109-110.

6. Hajek, M.: Nasal Accessory Sinuses, ed. 5, translated by J. D. Heitger and F. K. Hansel, St. Louis, C. V. Mosby Company, 1926, pp. 20-21.

7. Skillern, R. H.: The Catarrhal and Suppurative Diseases of the Accessory Sinuses of the Nose, Philadelphia, J. B. Lippincott Company, 1913, p. 107.

Data on 102 Antrums

Specimen Number		Distance from the Uncinate Border to the Ostial Margin in the Antrum, Mm.	Length of Canal Proper, Mm.	Direction of Canal	Comment
1R		10	6	Anterior inferior	
1L		13	6	Inferior lateral	
2R		8.5	6.5	Inferior lateral	
2L		6	2	Inferior lateral	
3R		10.5	7	Anterior inferior	
3L		4	4	Anterior inferior	There is no infundibulum, the bulla and uncinate are so markedly compressed by a deflected septum
4R		6	2	Lateral	
4L		7	3	Anterior inferior	
5R		10	6	Inferior	
5L	A	11	8	Inferior	Second ostium is an accessory one
	B	..	1		
7R		11.5	8	Inferior posterior	
7L	A	13	9	Inferior lateral	These are two distinct openings in the infundibulum and in the antrum; i. e., duplicate canals
	B	4	3	Lateral	
8R		6	2	Inferior lateral	
8L		6	1	Anterior inferior	
9R	A	7.5	2.5	Posterior inferior	Openings A and B are two distinct and separate "ostiums" from the infundibulum into the antrum; C is an accessory ostium
	B	7.5	3.5	Posterior inferior	
	C	..	1		
9L	A	9	3	Inferior posterior	Opening A is entirely distinct from B, which is at the tail end of a flattened infundibulum; the accessory "ostium" C passes under the uncinate to join A in one common opening into the antrum
	B	2	1.5	Lateral	
	C	..	7	Posterior	
10R		9	7	Posterior inferior	
11R	A	10	6	Anterior inferior	Canals B and C have a common infundibular opening with separate ones on the antral wall; canal A is a normal one distinct from B and C
	B	8	4	Inferior posterior	
	C	10	5	Posterior	
11L		10	4	Inferior lateral	
12R	A	11	8	Lateral	The accessory canal, B, extends posteriorly at an angle to join A in a common orifice into the antrum
	B	..	10.5	Posterior	
13R		9	3	Lateral inferior	
14R	A	9	4	Anterior inferior	A pair of duplicate canals
	B	5	2	Lateral	
14L		8	6	Lateral inferior	
15R		6	1	Posterior inferior	
15L		8	3	Posterior	
16L	A	10	6	Lateral	Canal B is an accessory opening
	B	..	7	Lateral	
18R		7	4	Posterior inferior	
18L		7	5	Inferior posterior	
19L		9	5	Lateral posterior	
20R		5	1	Inferior posterior	
21R		3	1	Anterior lateral	
21L		11.5	7.5	Inferior posterior	
22R		10	7	Lateral inferior	
22L		11	7	Lateral posterior	
23R		17	9	Inferior anterior	
23L		14	8	Anterior inferior	
24R		13.5	5.5	Anterior inferior	
24L	A	7	3	Anterior inferior	B is an accessory ostium
	B	..	1		
25R		10	7	Anterior lateral	
25L		10 (?)	10	Anterior lateral	There is no bulla; the middle turbinate is poorly developed; the ostium is really posterior to the uncinate process
26R		14	8	Inferior	
26L		9	3	Inferior	

Data on 102 Antrums—Continued

Specimen Number		Distance from the Uncinate Border to the Ostial Margin in the Antrum, Mm.	Length of Canal Proper, Mm.	Direction of Canal	Comment
27R		23.5	14.5	Inferior posterior	
27L		15	9	Inferior posterior	
28R		20	13	Posterior inferior	
28L		12	5	Inferior posterior	
29R		15.5	5.5	Lateral inferior	
29L		12	6	Lateral posterior	
30R		10	5	Anterior lateral	
30L	A	12.5	6.5	Lateral posterior	B is an accessory ostium
	B	..	1		
31R	A	19	12	Inferior posterior	B and C are accessory ostiums
	B	..	1		
	C	..	1		
31L		13	7	Lateral posterior	
32R		6	1	Anterior inferior	
32L		8	2	Inferior lateral	
33R		8.5	4.5	Lateral anterior	
33L		15	6	Lateral posterior	
34R		..	1.5	Lateral	Bulla is medial to uncinate; this process gradually slopes onto the nasoantral wall, which is almost replaced by an ostium of 1.5 by 2 cm.; there is no infundibulum
34L	A	..	2	Lateral	B is an accessory ostium; the uncinate process was destroyed in this specimen
	B	..	1		
35R	A	21.5	15.5	Posterior inferior	A is a normal canal; B an adjoining accessory canal with A, while C is a normal accessory ostium
	B	..	15	Inferior posterior	
	C	..	1		
35L	A	10	2	Lateral anterior	B is an accessory ostium
	B	..	1		
36R		9	4	Anterior inferior	
36L		3 (?)	3	Lateral	There is no bulla or hiatus semilunaris; the uncinate process levels off to the nasoantral wall
37R		9	3	Posterior	
37L		16	7	Lateral inferior	
38R		17	9	Anterior inferior	
38L		12.5	5.5	Anterior lateral	
39R	A	6	2	Anterior inferior	A is a normal and B an accessory canal, which join to form one opening in the antrum
	B	..	3	Inferior posterior	
39L		12	8	Inferior posterior	
40R		17	8	Lateral	
40L		13	6	Inferior lateral	
41R	A	7	1.5	Anterior inferior	A pair of normal adjoining ostiums
	B	6	1	Posterior inferior	
41L	A	10.5	4.5	Posterior inferior	A pair of normal adjoining canals
	B	14	9	Posterior inferior	
42R		12.5	6.5	Anterior inferior	
42L		15	10	Posterior	
43R	A	9	4	Anterior inferior	B is an accessory ostium
	B	..	1		
43L		12	4	Anterior inferior	
44R		10	4	Inferior posterior	
44L		8	4	Anterior inferior	
45R	A	11	7	Lateral inferior	B is an accessory ostium
	B	..	1		
45L	A	10	6	Posterior lateral	B is an accessory ostium
	B	..	2		
46R		14.5	7	Posterior inferior	
46L		8.5	6.5	Anterior inferior	
47R		2	1	Lateral	

Data on 102 Antrums—Continued

Specimen Number	Distance from the Uncinate Border to the Ostial Margin in the Antrum, Mm.	Length of Canal Proper, Mm.	Direction of Canal	Comment
48R	A 6	3	Inferior	B is an accessory ostium
	B ..	1		
48L	11	5	Inferior posterior	
49R	13	9	Inferior posterior	
49L	9	6	Lateral	
50L	17	10	Inferior	
51R	11	3	Inferior anterior	
51L	11	3	Inferior posterior	
52R	13	5	Inferior posterior	
53R	A 17	9	Inferior posterior	B is an accessory ostium
	B ..	1		
53L	15	8	Inferior posterior	
54R	15	6	Inferior anterior	
54L	11	4	Inferior posterior	
55R	12	8	Inferior	
55L	16.5	8.5	Inferior anterior	
56R	13	8	Anterior inferior	
56L	16	6	Anterior inferior	
57L	..	8	Inferior posterior	This is a specimen on which operation had been performed; there is no inferior or middle turbinate or infundibulum
58R	18	7	Inferior	
58L	A 27	12	Lateral	Specimen from a patient with Paget's disease; the maxillary bones are much thickened and the antrum small
	B ..	1		

openings, 91 (82.7 per cent) were canals, and 19 (17.3 per cent) were ostiums, or orifices. In short, most natural openings are canals.

The direction of this opening, or, better, canal, is as Skillern stated in some cases, but it varies considerably. In the study described in the first report,[1] the direction in the majority of cases was found to be as he mentioned. However, when more specimens were studied the direction showed much greater variation, and the course appeared much less certain. It appears from this study that the direction of the natural canal or ostium from the infundibulum into the antrum is, in a general way, inferior and lateral. It has a tendency to deviate posteriorly more frequently (56 per cent) than anteriorly (44 per cent). Several factors enter into the determination of the direction of these canals, which at times is difficult to decide. First, the opening may arise from the lateral wall, or it may originate in the floor of the infundibulum ethmoidale. Second, the plane of the infundibulum ethmoidale may be directed sagittally, or it may, and frequently does, lie at an angle to the sagittal plane. Third, both the uncinate process and the bulla may, by their position, exert pressure and direct the course of a probe in the maxillary opening, and they commonly do. Fourth, the true type of ostium, i. e., a window, especially if large, has a rather indefinite direction since there are no actual walls. On the whole, however, there usually is some general course.

In contrast to the natural openings, the accessory openings in most cases are true orifices, or ostiums, and not canals. In this group of 102 antrums there were 20 accessory openings; 4 of these were joined to normal openings and will be considered later. The remaining 16 were simple or normal accessory ostiums and had an average depth of 1.5 mm. Fifteen of the 16 (94 per cent) had a mediolateral dimension of less than 3 mm.; in other words, the simple accessory opening is practically always an orifice, or ostium. The 4 remaining accessory openings, which joined with another opening to enter the antrum, were all canals, being over 3 mm. in their course to the antrum.

It is interesting to observe that in some of the textbooks on the anatomy of the paranasal sinuses one can see illustrations of the antrum in which the artists have clearly drawn the maxillary ostium as a lumen leading into a canal. In some cases one may see a frontal section showing the whole length of this canal rather than a true window as one would expect in an orifice.

At about the time my first study on antrums was made, Myerson,[8] in a paper advocating catheterization of the natural orifice, wrote:

> Recently, Dr. Marvin Jones called my attention to the fact that he had noticed a nasomaxillary passageway in some of his films made following the injection of iodized poppy-seed oil 40 per cent. With this in mind, I reviewed the collection of Dr. Herman Rubin and found several such passageways which are outlined in the accompanying illustrations.

The clinical importance of considering the maxillary opening a canal rather than an ostium is twofold: First, one appreciates more readily how this passageway may become closed by edema of its mucosa. Second, one realizes that actual probing of the so-called natural ostium with a cannula is infrequent. It is evident that it is difficult when working through the vestibule of the nose to find the floor of the infundibulum and more so to palpate the opening leading into the antrum, because of the overhanging bulla and the close position of the lateral wall of the middle turbinate. Added to this is the fact that the average opening is a canal of about 5.5 mm. in length which has a variable direction, differing in every case, while the metal cannula has a predetermined curve of its own.

Many writers have felt that probing the natural orifice is difficult. Schaeffer[4] wrote:

> An examination of a large series of specimens leads the author to believe that it is impossible clinically in the vast majority of cases to sound the maxillary sinus through its normal ostium.

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8. Myerson, M. C.: Natural Orifice of the Maxillary Sinus, Arch. Otolaryng. **15**:716 (Jan.) 1932.

This point of view is evident to every one who makes a detailed anatomic study of the opening of the antrum. It was difficult to probe some of these canals even after the middle turbinate had been removed and one could see the floor of the infundibulum. Occasionally, after the opening which led into the antrum in the floor or lateral wall of the infundibulum had been seen and an attempt had been made to probe the opening, the bougie would not enter the sinus, because pressure was being exerted against the wall of the canal instead of following the sides. It required several shiftings of this direction finally to negotiate or thread the passage. In short, it was at times difficult to probe such a natural canal when one had the middle turbinate removed and was inspecting the infundibulum for an entrance into the sinus. Naturally in a patient, with no such exposure, the procedure is more difficult. Probably those who feel they enter the natural ostium usually puncture the membranous portion of the infundibulum or nasoantral wall, which is soft and gives little resistance to the sharp point of the cannula. It would seem better surgical procedure to traumatize and destroy ciliary function low down on the antral wall than to produce scars in the area of the opening, where ciliary function is most important for good drainage.

PROBLEM TWO

Maxillary "ostiums" are defined as either normal or accessory "ostiums," according to whether these openings are located in the infundibulum or outside this gutter. Those of the latter group are classed as accessory "ostiums" and are usually found inferior to the hiatus semilunaris, while those of the former are normal "ostiums." Schaeffer [4] and Davis,[5] respectively, described another group, which they designated as duplication of the maxillary ostium, or duplicate maxillary ostiums, which are defined as an additional or duplicated ostium in the floor of the infundibulum, posterior to the regular ostium. From a careful study of these 102 antrums a more detailed classification is offered. If one will study the table one will find that there are at least two groups of openings not included under any of these definitions and also that the type classed as duplicated "ostiums" is of two varieties. To be more definitive, the term "duplicate" when used in the classification which follows is meant to indicate two complete and distinctly different canals or ostiums. The term "adjoining" means two openings contiguous to each other at one end and as the canals extend joining to form one opening at the other end; in other words, they have a common opening on one wall and divide to form two separate openings on the other wall.

The classification is as follows:

1. Normal canal or ostium, single opening from the infundibulum ethmoidale into the antrum, such as specimens 1R, 2R, 3R and others. There were 79 of this type in the group, practically 77 per cent of all antral openings.

2. Duplicate normal canals or ostiums, two distinct and separate openings from the infundibulum with two distinct openings into the antrum such as specimens 7L and 9R. Among the 102 antrums there were 2 such openings, an incidence of roughly 2 per cent.

3. Adjoining normal canals, having two openings at one end and joining to form one opening at the other end, as in specimens 11R, 41R and 41L, which had one opening on the infundibular wall and divided as the canal extended into two openings into the antrum, or 14R, which had two openings on the infundibular side which joined to make one opening into the antral wall. There was a total of 4 specimens, or 4 per cent, with this variety of canal in this study.

4. Adjoining normal and accessory canals, composed of a normal canal and an accessory canal which join to form one opening into the antrum, as in specimens 9L, 12R, 35R and 39R. There were 4 examples, or practically 4 per cent, of these canals in 102 antrums.

5. Accessory ostium or canal, a single opening from the middle meatus and outside the infundibular gutter into the antrum, such as specimens 5L, 16L, 24L, 30L and others. There were 14 of these, or nearly 14 per cent, in this group.

6. Duplicate accessory ostiums or canals, with two distinct openings in the middle meatus outside the infundibulum ethmoidale, as in specimen 31R, which was the only one of this type in the group, constituting approximately 1 per cent.

7. Adjoining accessory canals, two openings in the middle meatus outside the infundibulum, joining to form one opening into the antrum. There were none of this type in this group, and it may never occur; however, it is reasonably conceivable to have such an arrangement.

Occasionally an antrum may have a combination of the foregoing openings. There were 2 such specimens in this group, namely, 9R, which had a pair of normal adjoining canals and an accessory ostium besides, and 35R, which had a pair of normal and accessory canals and an additional accessory ostium.

CONCLUSION

1. The so-called maxillary ostium in the majority of cases is a canal; in a group of 110 natural "ostiums" 82.7 per cent were canals of 3 mm. or more in length. The average length of this nasoantral canal, for 110 openings, was 5.55 mm. On the other hand, the (normal) accessory maxillary ostium is practically always an orifice, or ostium, and 94 per cent of 16 (normal) accessory openings were ostiums. The average mediolateral dimension of these 16 openings was 1.5 mm. Among all the accessory openings in one group of 20 cases, there were 75 per cent true ostiums and 25 per cent canals. The average length for all these accessory openings was 2.9 mm.

2. A more detailed classification of the types of openings from the middle meatus into the maxillary sinus is offered; the percentage and variety of these openings in this study of 102 antrums were: (1) normal canal or ostium, 77 per cent; (2) duplicate normal canals or ostiums, 2 per cent; (3) adjoining normal canals, 4 per cent; (4) adjoining normal and accessory canals, 4 per cent; (5) accessory ostium or canal, 14 per cent; (6) duplicate accessory ostiums or canals, 1 per cent; (7) adjoining accessory canals, 0 per cent. There were 2 specimens with a combination of these openings.

This study was carried on by permission of Dr. Wesley M. Baldwin and the Albany Medical College.

238 Lark Street.

XANTHOMATOSIS

IV. LIPOID PROTEINOSIS (PHOSPHATIDE LIPOIDOSIS)

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There are various types of xanthoma which may result in lesions involving the mucous membranes of the mouth, throat, larynx and trachea. We wish to report a case of lipoid proteinosis (Urbach [1]) in which such lesions were presented and to demonstrate that this condition is a definite clinical and especially a definite histologic and histochemical entity. It will be differentiated especially from other forms of xanthomatosis involving the mucous membranes, such as disseminate xanthomatosis, hepatosplenomegaly with lipoidosis of the skin and mucous membrane of Bürger and Grütz, and in some cases Hand-Schüller-Christian disease.[2]

Lipoid proteinosis was first recognized as a form of xanthomatosis by Urbach [3] and by Urbach and Wiethe in 1929,[4] under the title "lipoidosis cutis et mucosae," although it had been described by Siebenmann [5]

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1. Urbach, E.: Lipoidproteinose (Lipoidosis cutis et mucosae), in Jadassohn, J.: Handbuch der Haut- und Geschlechtskrankheiten, Berlin, Julius Springer, 1932, vol. 12, pt. 2, pp. 335-352.

2. (*a*) Montgomery, H.: Xanthomatosis: III. Cutaneous Xanthoma Especially in Relation to Disease of the Liver, J. Invest. Dermat. **1**:325-351 (Oct.) 1938. (*b*) Montgomery, H., and Osterberg, A. E.: Xanthomatosis: Correlation of Clinical, Histopathologic and Chemical Studies of Cutaneous Xanthoma, Arch. Dermat. & Syph. **37**:373-401 (March) 1938.

3. Urbach, E.: Beiträge zu einer physiologischen und pathologischen Chemie der Haut: IV. Ueber eine familiäre Lipoidose der Haut und der Schleimhäute auf Grundlage einer diabetischen Stoffwechselstörung, Arch. f. Dermat. u. Syph. **157**:451-466, 1929.

4. Urbach, E., and Wiethe, C.: Lipoidosis cutis et mucosae, Virchows Arch. f. path. Anat. **273**:285-319, 1929.

5. Siebenmann: Ueber Mitbeteiligung der Schleimhaut bei allgemeiner Hyperkeratose der Haut, Arch. f. Laryng. u. Rhin. **20**:101-109, 1908.

in 1908 and by Wiethe [6] in 1924 and in 1926 as a hyaline change of the mucous membranes associated with hyperkeratotic lesions of the skin. Tripp,[7] in 1936, was the first to report a case in this country. Two additional cases, together with a review of the literature, were presented by Wise and Rein [8] in 1938. More recent conceptions regarding the various types of xanthomatosis have been considered elsewhere by one of us (Montgomery [2a]) and by Montgomery and Osterberg.[2b] They will be referred to in this paper only as they apply to the study of lipoid proteinosis.

REPORT OF A CASE

A farm hand aged 21 first came to the Mayo Clinic in January 1914 because of attacks of precordial pain, which had begun after he had been thrown out of a buggy four months previously. On examination he was found to have definite symptoms of exophthalmic goiter, and at operation Dr. MacCarty made a diagnosis of hypertrophic parenchymatous thyroid (exophthalmic goiter). In view of the subsequent history it is interesting that the examination of the nose and throat in 1914 revealed the presence of stomatitis, pharyngitis, laryngitis and a peculiar bleblike formation over the tonsils.

In June 1915 the patient wrote to Dr. D. C. Balfour, who had been the surgeon: "I have been losing my speech slowly ever since I left there. It is due to those operations, I suppose." He was advised to return for further examination. In answer to a written questionnaire in 1920 the patient complained of no symptoms of exophthalmic goiter except a continued hoarseness.

The patient returned to the clinic in February 1938 at the age of 45, because the hoarseness had gradually increased during the past six months and because the tip of the tongue had been sore since six months previously, when he had bitten it. He had changed his occupation to operating a night club. Further questioning revealed that the hoarseness had been present since infancy, although not severe until the past six months. It apparently had little or nothing to do with the exophthalmic goiter. He said he had had open sores on the buttocks as a child as well as lesions over the elbows and knees for twenty years and involvement of the chin and mucocutaneous junctions for one and a half to two years. He recalled that one nephew might have had a slightly similar cutaneous trouble. No family history of diabetes could be obtained.

On examination in February 1938 the patient was found to have papulosquamous, infiltrated plaques over the elbows and knees. The lesions on the elbows were described as edematous, papillomatous, mulberry-like soft tumors. The lesions presented a slightly brownish hue and were more suggestive of localized neurodermatitis than of xanthoma tuberosum. Similar lesions were

6. Wiethe, C.: Kongenitale, diffuse Hyalinablagerungen in den oberen Luftwegen, familiär auftretend, Ztschr. f. Hals-, Nasen- u. Ohrenh. **10**:359-363, 1924; Ueber lokale Hyalinablagerungen in den oberen Luftwegen, Acta oto-laryng. **10**: 237-248, 1926.

7. Tripp, R. N.: Lipoidosis Cutis et Mucosae, New York State J. Med. **36**: 619-626 (April 15) 1936.

8. Wise, F., and Rein, C. R.: Lipoidosis Cutis et Mucosae (Lipoid Proteinosis of Urbach): Report of the Disease in Two Sisters, with a Histologic and Histochemical Investigation in One Case, Arch. Dermat. & Syph. **37**:201-217 (Feb.) 1938.

seen about the umbilicus and gluteal cleft, about the anus, on the chin and about the corners of the mouth. There were possibly some early lesions on the shaft of the penis, on the scrotum and axilla and on the sides of the neck. Lesions were not present on the fingers, nor was there any variola-like pock marking of the face, such as was emphasized in Urbach's descriptions of this disorder. Examination of the oral cavity revealed enlargement (grade 3) of the tonsils, which were cryptic and infected. An area of induration without ulceration on the ventral surface of the tip of the tongue and a nodular induration of the dorsum of the tongue were present. There was marked scarring of the posterior pharyngeal wall and to some extent of the margins of the epiglottis. On the left margin of the posterior pharyngeal wall there was one firm submucous nodule that presented a definite xanthomatous hue. Similar lesions were seen on the inner surface of the lower lip. There was definite thickening of the vocal cords and a small amount of papillary thickening in the posterior commissure of the larynx. The nodular induration of the tongue made it stiff and woodlike, without any alteration of its normal color. The vestibule of the nose was crusted.

Because of the history of exophthalmic goiter the possibility of an unusual type of localized myxedema was considered, as was colloid or hyaline degeneration. Biopsy of tissue from the elbow was reported on by one of us (Montgomery). The specimen showed definite telangiectasia and peculiar colloid degeneration of the connective tissue. Epithelial changes similar to those seen in verruca senilis or epithelial nevi were seen. There was no evidence of deposits of amyloid or mucin. Frozen sections stained with sudan III showed faint deposits of lipoids about the blood vessels in the upper cutis. A specimen taken for biopsy from a lesion on the neck revealed moderate hypertrophy of the sebaceous glands and a questionable faint deposit of mucin in the connective tissue in the upper cutis.

The patient returned a month later in March 1938, at which time injection of congo red intracutaneously into a plaque on the elbow failed to reveal the presence of any amyloid (figs. 1 and 2).[9] A diagnosis of lipoid proteinosis of Urbach was then first considered and was confirmed by histologic, histochemical and chemical analysis (figs. 3, 4 and 5 and table). A specimen taken for biopsy from the lesion on the posterior pharyngeal wall stained with sudan III showed a dirty orange-red homogeneous staining of large masses of collagen, together with a definite mantle of lipoids deposited about and outlining the superficial vessels. These lipoids occurred in the form of small granules, chiefly extracellular. No foam cells were demonstrable. On the other hand, there was no evidence of necrosis. The use of the polarizing microscope failed to reveal any doubly refractile lipoids. Similar histologic descriptions are equally applicable to another specimen, removed from the skin of the elbow. In both specimens the connective tissue appeared homogeneous, and with Van Gieson stain there was a dirty, yellow-gray staining of the connective tissue about the blood vessels in the upper part of the cutis. The elastic tissue was destroyed in these areas. With hematoxylin and eosin stain a peculiar degeneration of connective tissue was at first suggested, and many of the spaces left by the lipoid deposits resembled dilated lymphatics. It is thus easy to understand why Siebenmann and later Wiethe mistook this condition for a hyaline degeneration.

General examination of the patient otherwise gave essentially negative results. Tests showed that the sugar content of the blood and the dextrose tolerance

9. Nomland, R.: Localized (Lichen) Amyloidosis of the Skin: Report of Two Cases, with Vital Staining of the Amyloid Nodules by Congo Red Injected Intracutaneously or Subcutaneously, Arch. Dermat. & Syph. **33**:85-97 (Jan.) 1936.

were normal. The urea content of the blood was 28 mg. per hundred cubic centimeters. The basal metabolic rate was —8 per cent, and the bilirubin content of the serum was 1.1 mg. per hundred cubic centimeters. There was no evidence of retention of the dye in the liver function test (bromsulphalein). There was no

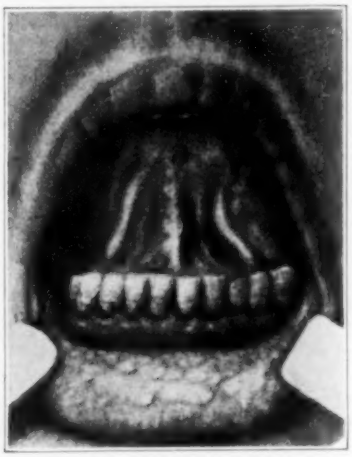

Fig. 1.—Yellow-orange deposits of lipoids on the under surface of the tongue and lower lip (courtesy Dr. Erich Urbach).

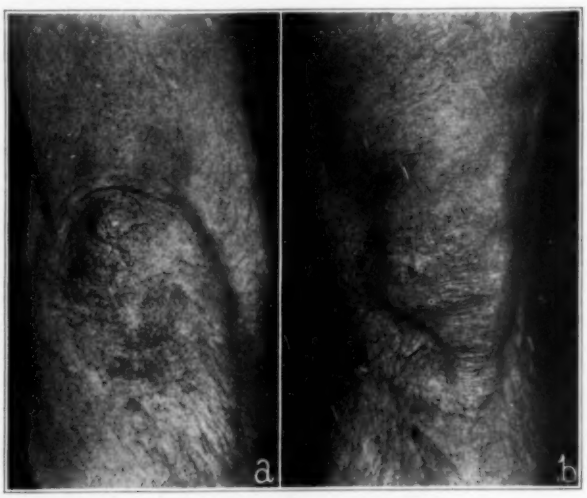

Fig. 2.—Papulosquamous, slightly infiltrated plaques on elbow (*a*) and knee (*b*) presenting a brownish and not a xanthomatous hue.

evidence of any cardiovascular disease, and the electrocardiogram was reported normal. Studies of the lipoid in the blood plasma in February 1938 gave normal results. Those in April 1938 revealed a disproportionate increase in lecithin. Quantitative chemical analysis of a portion of a large plaque from the elbow revealed that 79 per cent of the lipoids were in the form of lecithin. In the

supposedly normal skin adjacent to the plaque more than twice as much lecithin (phosphatide phosphorus times 25) was seen in the skin as is normally present. These histochemical studies establish, we believe, the diagnosis of lipoid proteinosis and confirm Urbach's contention that this condition is a phosphatide lipoidosis.

NOTE.—At the end of August 1938, just after this paper was submitted for publication, the patient returned for further examination. He had followed a diet free of animal fat for more than two months at home, without any change in his condition. He thought that his hoarseness was increasing and that there had been decrease in vision. Ocular examination revealed several small lipomas at the margin of both upper lids, but his eyes were otherwise essentially normal. The condition of the mouth and throat remained as previously described except for additional thickening of the margins of the epiglottis and thickening in the inner aspect of the right arytenoid region, which had not been present previously. A

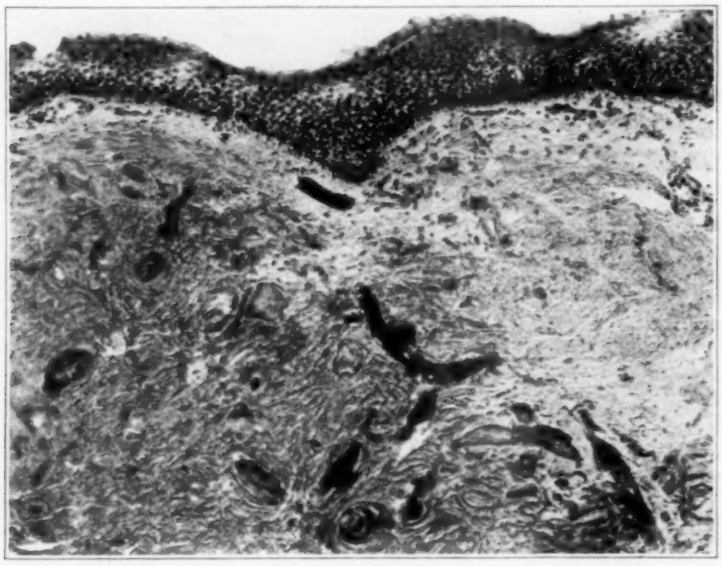

Fig. 3.—From the posterior pharyngeal wall; frozen section stained with sudan III; orange-red deposits of lipoids appearing black in the photomicrograph, forming a mantle outlining the blood vessels and also forming a diffuse homogeneous mass in the left portion of the picture (× 65).

few papular lesions were seen on one finger. The concentration of lipoids in the blood plasma was normal. There was no relative increase in the amount of lecithin in the plasma. Roentgenologic examination of the skull did not disclose any abnormality. The patient was put on a diabetic diet and given 10 units of insulin twice a day, because of the good results obtained by Tripp in 1 case. The patient was kept under observation for seven days without any change in the mucocutaneous lesions. He was sent home to continue the treatment. He has not answered a recent letter of inquiry.

SYMPTOMATOLOGY AND TREATMENT

Lipoid proteinosis has been described by Urbach as a constitutional nevoid and familial disturbance of lipoid metabolism. The disease usually

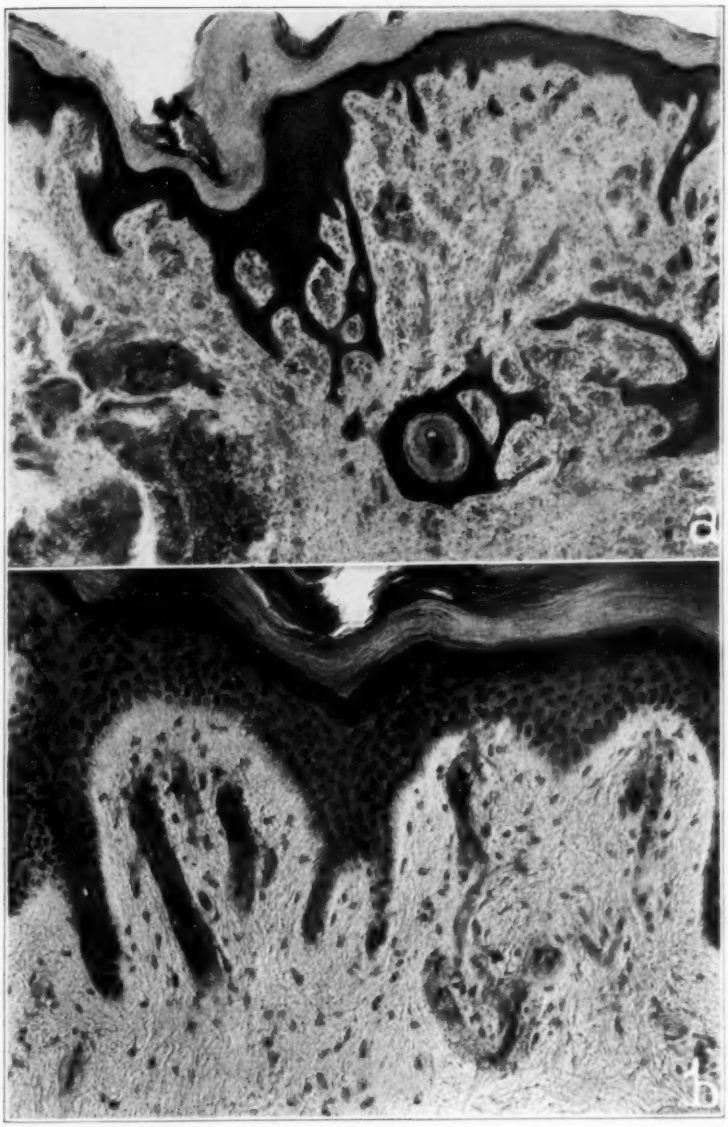

Fig. 4.—From the elbow; frozen section stained with sudan III; *a*, hyperkeratosis, irregular acanthosis, outlining of all the superficial capillaries by a mantle of lipoids about the vessels, appearing black in the picture, actually orange-red, and hyaline change of connective tissue, with diffuse infiltration of lipoids staining black in left lower corner (× 55); *b*, granules of lipoids, chiefly extracellular, forming a mantle and outlining the superficial capillaries in the upper portions of the cutis, without foam cells (× 145).

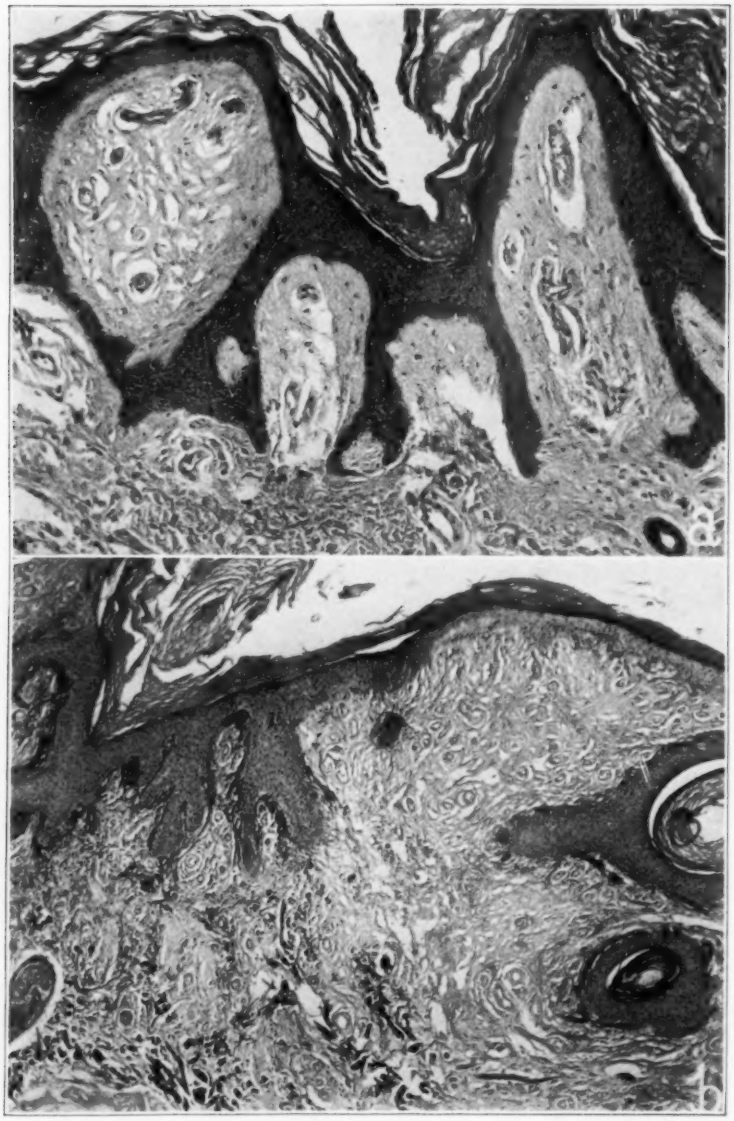

Fig. 5.—Paraffin sections from the elbow; *a*, hematoxylin and eosin stain showing a peculiar type of homogenization of the connective tissue suggesting amyloid or hyaline degeneration, clear space about the capillaries in the papillary bodies where the deposits of lipoids were, relative hyperkeratosis and irregular acanthosis of the epidermis; *b*, Van Gieson stain showing a similar picture to figure 5 *a*, dark-staining, normal collagen fibers, with the rest of the connective tissue giving a diffuse homogeneous appearance and taking a dirty grayish yellow stain.

starts in infancy. The earliest symptom is hoarseness. The nodular and hyperkeratotic cutaneous lesions may not appear until much later. In most of the cases there is a pocklike eruption on the face, which appears during infancy and leaves soft, depressed, variola-like scars. The extensor surfaces of the elbows and knees are frequently involved, as are also the fingers. The scalp frequently shows a sparse growth of hair. The mucocutaneous junctions of the mouth and of the genitalia, including the true mucous membrane of the labia pudendi and the rectal mucosa,[10] are involved in this process, as are the lips, tongue, buccal

Biochemical Studies of Lipoids in the Blood Plasma and Tissue

Blood Plasma	Feb. 10, 1938		April 10, 1938		Average Normal	
	Milligrams per 100 Cc. of Plasma	Percentage of Total Lipoids	Milligrams per 100 Cc. of Plasma	Percentage of Total Lipoids	Milligrams per 100 Cc. of Plasma	Percentage of Total Lipoids
Total cholesterol	214	39	181	39	180	34
Cholesterol esters	166	78*	146	80*	125	70*
Lecithin	181	33†	258	55†	180	34†
					225‡	43‡
Fatty acids	338	61	289	61	345	66
Total lipoids	552	..	470	..	525	100

Tissue	April 13, 1938		April 13, 1938		Approximate Values for Normal Skin§	Percentage of Total Lipoids
	Lesion§	Percentage of Total Lipoids	Skin Adjacent to Lesion§	Percentage of Total Lipoids		
Wet weight in milligrams	840		780			
Total cholesterol	0.3	16	0.3	14	0.1-0.3	Traces to 16
Cholesterol esters	0.3	100*	0.3	100*	.....	Free > esters
Lecithin	1.5	79†	1.6	76†	0.1-0.9	10-30
Fatty acids	1.6	84	1.8	86	0.7-2.4	74
Total lipoids	1.9	..	2.1	..	1.0-3.0	

* Expressed as percentage of cholesterol.
† Calculated as percentage of total lipoids but included in fatty acids. The determinations are based on the newer method of analysis (Youngberg, G. E., and Youngberg, M. V.: Phosphorus Metabolism: I. A System of Blood Phosphorus Analysis, J. Lab. & Clin. Med. **16**: 158-166 [Nov.] 1930).
‡ Based on older methods of analysis (Montgomery and Osterberg [2b]).
§ Expressed in milligrams per hundred grams.

cavity, pharynx and larynx. In a case of abortive lipoid proteinosis Urbach and Wiethe[11] found large masses of cholesterol crystals in the tonsils but attributed them to chronic tonsillitis, in which such deposits are not infrequent, in the absence of any lipoid disturbance. In 8 of 14 cases compiled by Urbach in the *Handbuch* it was necessary to perform laryngotomy to prevent asphyxia. In several cases the lesions regressed after the first pregnancy. In most of the cases there has been a definite

10. Hansen, P.: Ein Fall von Lipoidproteinose, Arch. f. Dermat. u. Syph. **175**:618-622, 1937.

11. Urbach, E., and Wiethe, C.: Ein abortiver Fall von Lipoidproteinose unter dem klinischen Bilde von warzenartigen Excrescenzen (Lipoidkeratomen) an den Fingern, Arch. f. Dermat. u. Syph. **168**:94-102, 1933.

tendency toward diabetes as evidenced by tests for blood sugar and sugar tolerance. This is not always true, however, as evidenced by the case which we have reported and also by the case reported by Hansen.[10] Tripp has reported a case in which involution of the lesions occurred after administration of a diet low in carbohydrates and small doses of insulin. Radium has not proved of value in treating the lesions of lipoid proteinosis.

HISTOCHEMISTRY

On the basis of histochemical studies Urbach changed from the nonspecific name he had originally given this condition, lipoidosis cutis et mucosae, to lipoid proteinosis (phosphatide lipoidosis), because the lipoids are soluble in boiling acetone and in hot dehydrated alcohol whereas more common types of xanthomatous deposits of cholesterol are soluble in hot alcohol but not in hot acetone. Schreus [12] recently reported a case in which the lipoids were soluble in 70 per cent alcohol but the clinical and the histologic picture were characteristic. Because the hot alcohol and hot acetone did not remove the contents of the infiltrating masses, he regarded lipoid proteinosis as an infiltrative process similar to that seen in amyloidosis and not a degenerative phenomenon. Various histochemical stains also support the conception of the deposits of phosphatides (lecithin).

The lipoid content of the blood plasma, as a rule, has been reported within normal limits, although in Hansen's case there was definite lipemia, with a relative and absolute increase in lecithin and fatty acids, and in Tripp's case there was a marked increase in lecithin. In our case the lipoid content of the blood was normal at the first determination, and at the second determination there was a relative and absolute increase only in the lecithin.

Because of the different methods of analysis it is difficult to make anything but a general comparison of different authors' studies of lipoid, especially of the few quantitative determinations of the lipoid content in the lesions of the skin or of the mucous membrane. Urbach [1] quoted Epstein and Lorentz as finding more lecithin and less nitrogen in both the ether-soluble and the alcohol-soluble lipoid fraction in material from the tonsil and epiglottis in Faustmann's case than in normal material from the same regions. Hansen analyzed a small portion of hyperkeratotic skin from one finger and found the lipoid content to be 1.56 per cent and the lecithin only 0.338 per cent (22 per cent of the total lipoids). This low figure of the lecithin may, however, have resulted from taking too small a piece of tissue for quantitative analysis. In our study (table) immediate analysis of an adequate specimen revealed

12. Schreus: Lipoidproteinose Urbach-Wiethe, Zentralbl. f. Haut- u. Geschlechtskr. **53**:529, 1936.

that 79 per cent of the lipoids were in the form of lecithin and that even in the normal-appearing skin adjacent to the lesion there was a similar high amount of lecithin, two and a half times the maximal content of normal skin. At the same time the total lipoid content of the xanthomatous lesion was within the normal range for total lipoids in the skin.

Thus the increase in lecithin of both blood and tissue in our case supports Urbach's contention that this condition is different from other forms of xanthomatosis. It also suggests that phosphatides (lecithin) may play a role in the extracellular deposits of lipoids in the tissue, as does free cholesterol in other forms of xanthomatosis.[2] The diffuse staining of large homogeneous masses in the cutis without any phenomenon of necrosis of the tissue also supports the conception of an association of lipoid with protein and of an infiltrative rather than a degenerative type of lipoidosis. Thannhauser and Magendantz [13] have divided phospholipids quantitatively into monoaminophosphatides (lecithin-cephalin) and diaminophosphatides (sphingomyelin). The latter are increased especially in Niemann-Pick disease. We did not split up the phospholipids in our case according to Thannhauser's method into monoaminophosphatides and diaminophosphatides. This should be done in analyzing both the blood plasma and the tissue in future cases of lipoid proteinosis.

DIFFERENTIAL DIAGNOSIS

The term lipoidosis cutis et mucosae is equally applicable to many of the types of xanthomatosis to be discussed in differential diagnosis and hence should be abandoned in favor of the more specific term lipoid proteinosis (phosphatide lipoidosis). There are various types of xanthomatosis which may result in lesions involving the mucous membranes of the mouth. In xanthoma disseminatum [2b] the larynx and pharynx may be involved with xanthomatous infiltrations so extensive as to necessitate tracheotomy. The cases of New,[14] and of Finney, Montgomery and New [15] belong in this group. Thannhauser and Magendantz erroneously grouped these cases and lipoid proteinosis together. The presence of typical foam or xanthoma cells and Touton giant cells in the lesions of disseminate xanthomatosis is in contrast to the absence of foam cells and the presence of extracellular deposits of lipoids in lipoid proteinosis. The lipoid content of the blood in each condition is usually normal,

13. Thannhauser, S. J., and Magendantz, H.: The Different Clinical Groups of Xanthomatous Diseases: A Clinical Physiological Study of Twenty-Two Cases, Ann. Int. Med. **11**:1662-1746 (March) 1938.

14. New, G. B.: Xanthoma of the Pharynx and Larynx, Arch. Otolaryng. **22**:449-453 (Oct.) 1935.

15. Finney, W. P.; Montgomery, H., and New, G. B.: Xanthoma Multiplex: Two Cases Involving the Larynx and Trachea, and Associated with Diabetes Insipidus, J. A. M. A. **99**:1071-1074 (Sept. 24) 1932.

although there may be a relative increase in the amount of lecithin in lipoid proteinosis. The lipoids of the tissues in disseminate xanthomatosis show a relative increase in cholesterol and occasionally in lecithin. This condition is usually associated with diabetes insipidus. At times, in addition, there is a picture of Hand-Schüller-Christian disease. In children there may be an association of xanthoma tuberosum and disseminate xanthomatosis, with or without Hand-Schüller-Christian disease. In such instances there may be an increase in the lipoid content of the blood, but again the histologic picture is a typical one of ordinary xanthoma with characteristic xanthoma cells.

A rare condition known as hepatosplenomegaly with cutaneous and mucosal lipoidosis of Bürger and Grütz [2a] reveals an increase in free cholesterol and in lecithin in the lipoids of both blood and tissue, but again typical xanthoma cells are present histologically, and the enlargement of the liver and spleen readily distinguishes this condition from lipoid proteinosis. In Niemann-Pick disease one is dealing with a phosphatide lipoidosis, but again foam or xanthoma cells are present, and the same is true with Gaucher's disease, which has to do with disturbance in cerebrosides (kerasin).

When any of the aforementioned conditions involves the mucous membranes of the mouth, the lesions in all the mucous membranes have a typical xanthomatous hue. In lipoid proteinosis, on the other hand, the majority of the lesions on the mucous membranes are of the same color as the surrounding mucosa or are purplish, and only a few of the larger lesions are suggestive clinically of xanthoma. The cutaneous lesions in lipoid proteinosis resemble those of neurodermatitis or of an epithelial nevoid disturbance more than those of xanthoma, and as a rule they lack any yellowish hue.

Because the lesions in both lipoid proteinosis and necrobiosis lipoidica diabeticorum are usually seen in association with diabetes, the two conditions have been thought to be allied. In 3 cases of necrobiosis lipoidica diabeticorum studied recently, the various lipoids in the blood have been within normal limits. In 1 case, in which the lipoids in the tissues were studied, there was a tremendous increase in lecithin without any increase in any of the other lipoids. This is in contrast to findings previously reported in the literature and summarized by Usher and Rabinowitch,[16] that free cholesterol predominated over cholesterol esters and the lecithin was not increased. In both necrobiosis and lipoid proteinosis, the deposits of lipoids are chiefly extracellular, and no foam cells or xanthoma cells are present; otherwise, however, the histologic changes are entirely different in the two conditions. In necrobiosis lipoidica

16. Usher, B., and Rabinowitch, I. M.: Necrobiosis Lipoidica Diabeticorum: Report of a Case with Clinical, Pathologic and Biochemical Observations, Arch. Dermat. & Syph. **35**:180-187 (Jan.) 1937.

diabeticorum there is marked necrosis of the connective tissue, which is not seen in lipoid proteinosis.[17] Cutaneous lesions in the two conditions present entirely different pictures, and rarely if ever are the mucous membranes affected in necrobiosis lipoidica diabeticorum. Both conditions have been shown to occur independent of any latent or frank diabetes.

Montgomery and Osterberg [2b] have recently discussed so-called extracellular cholesterosis of Urbach and given reasons for regarding most of the cases as being simply instances of a fibrous type of xanthoma tuberosum. Definite xanthoma cells may be demonstrated, although they are not numerous. The fibrosis seen histologically is different from the hyaline change in the connective tissue seen in lipoid proteinosis, and there is not the characteristic mantle of lipoids deposited about the superficial blood vessels. Finally, lipoid proteinosis is easily differentiated from amyloidosis, colloid degeneration of the skin and lipoid degeneration of the elastic tissue by the concomitant clinical, histologic and histochemical findings.

SUMMARY AND CONCLUSIONS

A case of lipoid proteinosis (phosphatide lipoidosis) of Urbach is reported; it presented several atypical clinical features, including the onset of severe hoarseness only late in life rather than in infancy and the failure to show any pocklike scarring of the face or nodular or hyperkeratotic lesions on the fingers. The histologic and histochemical changes were characteristic and, we believe, diagnostic. There was a peculiar type of lipoid infiltration in the connective tissue, resulting in homogeneous masses staining a dirty orange-red with sudan III in contrast to the bright scarlet-red staining reaction of lipoids in ordinary xanthoma. Similar deposits of lipoids form a mantle about all the superficial blood vessels. No foam or xanthoma cells are present, and there is no evidence of necrosis. The histologic picture in the past has been confused with hyaline changes or other degenerative changes in the connective tissue. Histochemical studies show there is a marked increase of phosphatides in the lesions in the skin and substantiate Urbach's contention that this condition is phosphatide lipoidosis, presumably due to increase in lecithin in both blood and skin. It is important to differentiate this type of lipoidosis from other forms of xanthomatosis because of their varying prognoses. Lipoid proteinosis is usually a nevoid, familial disturbance beginning in infancy and associated with a tendency toward diabetes. Our case illustrates, however, that symptoms of this disorder may not become prominent until late in adult life and that a definite familial history and evidence of diabetes may be absent.

17. Michelson, H. E., and Laymon, C. W.: Necrobiosis Lipoidica Diabeticorum (Urbach); Dermatitis Atrophicans Lipoides Diabetica (Oppenheim), J. A. M. A. **103**:163-169 (July 21) 1934.

TECHNIC OF LARYNGOFISSURE FOR CANCER OF THE LARYNX

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"Laryngofissure," "laryngotomy," "thyrofissure," "thyrotomy"—all these terms indicate a division of the thyroid cartilage in the midline. They do not include excision of the diseased tissue within the larynx. The operation might more properly be designated "laryngofissure with excision," so as to convey a better understanding of the nature and extent of the procedure.

The origin of laryngofissure is usually traced to Desault.[1] He first suggested it some time during the latter part of the eighteenth century. In those days the operation was termed laryngotomy, or opening of the larynx, and was considered a subdivision of bronchotomy. The other subdivision was tracheotomy. Laryngotomy consisted of dividing the cricothyroid membrane transversely or of cutting the thyroid cartilage longitudinally. In 1812 Bichat[2] wrote that laryngotomy "was not described except by some authors who restrained the use of it too much and retrenched the process." Bichat preferred "laryngotomy" to "tracheotomy." He claimed for it greater accessibility, less hemorrhage and a simpler technic.

A brief account of the incident which led Desault to suggest laryngotomy might be of interest:

Desault (1744-1795) was called to see a man who had aspirated a cherry. It was determined that the cherry had lodged in the left side of his larynx. Desault advised division of the thyroid cartilage, but the other consultants rejected the operation because of "the danger of hemorrhage, the difficulty of dividing the thyroid cartilage, and the possibility of an aerial fistula after operation." When the patient died, two years later, of laryngeal phthisis, autopsy revealed that the cherry in his larynx had caused his death.

From the Department of Otolaryngology, Brooklyn Cancer Institute.

Read at the Forty-Third Annual Meeting of the American Academy of Ophthalmology and Otolaryngology, Washington, D. C., Oct. 10, 1938.

1. Desault, P. J.: The Surgical Works, or Statement of the Doctrine and Practice of P. J. Desault by Xavier Bichat, translated by E. D. Smith, Philadelphia, Thomas Dobson, 1814, vol. 1, p. 223.

2. Bichat, F. X., in Desault,[1] p. 234.

Since the time of Desault the operation has passed through many phases. In the early days surgical procedures were performed without accurate diagnosis, without anesthesia, with crude instruments and with awkward postoperative care. As a result there were many serious sequelae and failures. Brauers [3] has the credit for having performed the first laryngofissure, in 1833. Without anesthesia and without a tracheotomy he exposed a papillomatous growth of the larynx and cauterized it. This was an unusual achievement. Buck [4] performed the first laryngofissure in America, in 1851, while Gibbs [5] is credited with having introduced laryngofissure in England, in 1864. Gibbs remarked that the operation ought to be one of the simplest performed on the neck.

The introduction of the laryngoscope by Manuel Garcia,[6] of London, in 1855, resulted in increased interest in laryngeal disease, with a consequent increase in its surgical treatment. During the following fifty years laryngofissure was performed by many distinguished laryngologists. It has had its greatest vogue in England. Gibbs,[5] Durham,[7] Butlin [8] and Semon [9] did much to develop it. Since 1900 Tilley,[10] Lack,[11] Moore,[12] Thomson [13] and others have contributed to the subject. In this country many have advanced the knowledge of it, notably J. Solis Cohen, Delavan, Jackson, New, Tucker and Clerf.

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3. Brauers, cited by Ehrmann, C. H.: Histoire des polypes du larynx, Strasbourg, imp. de Vve. Berger-Levrault, 1850, p. 12.

4. Buck, G.: On the Surgical Treatment of Morbid Growths Within the Larynx, Tr. A. M. A. **6**:509, 1853.

5. Gibbs, G. D.: The First Attempt in England to Remove a Growth from the Larynx Through Division of the Pomum Adami, Brit. M. J. **2**:327, 1865.

6. Garcia, M.: Observations physiologiques sur la voix humaine, Paris, Masson, 1855.

7. Durham, A. E.: On the Operation of Opening the Larynx by Section of the Cartilages, etc., for the Removal of Morbid Growths, Med.-Chir. Tr., London **55**:17, 1872.

8. Butlin, H.: The Operative Surgery of Malignant Diseases of the Larynx, Brit. M. J. **2**:1033, 1895.

9. Semon, F.: The Operative Treatment of Malignant Disease of the Larynx, Brit. M. J. **2**:1113, 1903.

10. Tilley, H.: Diseases of the Nose and Throat, London, H. K. Lewis & Co., 1918.

11. Lack, L. H.: Partial Excision of the Thyroid Cartilage as an Alternative to Thyrotomy in Malignant Disease of the Vocal Cords, Proc. Roy. Soc. Med. (Laryng. Sect.) **9**:62, 1916.

12. Moore, I.: Intrinsic Cancer of the Larynx and the Operation of Laryngofissure, J. Laryng., Rhin. & Otol. **33**:129, 166, 202, 234, 260 and 294, 1918.

13. Thomson, S. C., and Colledge, L.: Cancer of the Larynx, New York, The Macmillan Company, 1930.

The objective of the operation is the removal of the cancer with as little compromise of the integrity of the larynx as is consistent with complete eradication of the disease.

The story of the operation and its indications is interesting. Originally it included section of the cricoid cartilage and was indicated for benign growths as well as for malignant ones.

Cancers were poorly selected, so that recurrences soon followed the operation. Many cancers, some with secondary infections, were operated on which were not suitable for laryngofissure under any circumstance. After the operation the interior of the larynx was packed, and the packing was left in for several days, a factor which favored complications; in addition, the patient was kept in the Trendelenburg or the lateral recumbent position, without a pillow, for some time. These postoperative measures favored the development of pneumonia, which occurred rather frequently.

Tracheotomy was usually performed, and is still being done by many operators, as part of the laryngofissure. Most surgeons remove the tube on the same day or within twenty-four hours, as soon as they are certain the patient can swallow. Tracheotomy has proved to be unnecessary in my experience. It is conceivable that a patient might require a tracheotomy after operation, because of bleeding or an unusual reaction. In such a case I should proceed as follows: The cricothyroid membrane would be exposed and a tracheotomy tube temporarily placed through it. Immediately after the placement of the tracheotomy tube in this location, a deliberate classic low tracheotomy would be performed and the upper tube withdrawn. The upper tube would be in place for only a few minutes and could do no damage. This technic is frequently followed in my service when a rapid tracheotomy is required in an emergency, especially if the operator is not certain of being able to introduce a bronchoscope or an indirect intubation tube quickly.

Until 1907 the internal perichondrium was not given special consideration. At that time J. Solis Cohen [14] suggested the removal of the soft parts, together with the perichondrium, so as to insure a more thorough removal of the diseased tissue. The procedure suggested by Cohen proved a marked advance in the technic of laryngofissure. It was claimed for his method that the growth could be removed in one piece, untouched by any instrument. Almost ten years later Lambert Lack suggested the removal of a part of the thyroid cartilage together with the overlying soft tissues. This, he maintained, would facilitate exposure and removal of the cancerous area. He contended that the two halves of the larynx could be more readily retracted as a result.

14. Cohen, J. S.: Modern Procedures in Excision of Intrinsic Malignant Growths of the Larynx, Laryngoscope **17**:365, 1907.

He asserted that pain on swallowing and soreness resulted from the forcible retraction of the thyroid alae and that they would be eliminated by this procedure. I have not encountered pain following retraction of the alae. Resection of the cartilage is of value if the cancer has penetrated beyond the inner perichondrium and into the cartilage. If I am certain that this is not the case I do not resect the cartilage. Removal of the cartilage converts the previously designated laryngofissure into a hemilaryngectomy or subhemilaryngectomy.

OPERATION

Indications.—Cancer localized to one side of the larynx, not including the area of the arytenoid or of the commissure and not extending above the ventricular band or below the level of the cricoid rim is suitable for removal by laryngofissure.

Procedure.—The usual preliminary, preparatory and diagnostic procedures are carried out. The patient is given 1 grain (0.06 Gm.) of phenobarbital the evening before, 1 grain (0.06 Gm.) six hours before, and 3 grains (0.19 Gm.) one hour before operation.

Anesthesia.—The interior of the larynx is anesthetized with a 10 per cent solution of cocaine and epinephrine as for direct laryngoscopic examination before the patient is placed on the table. This anesthesia eliminates the necessity for anesthetizing the larynx after the thyroid alae have been separated or after an opening has been made through the cricothyroid membrane for this purpose. The usual cocainization, which is carried out on the table, is always accompanied by struggling and coughing. A general anesthetic is used by some, but it has certain disadvantages: There is more bleeding, and much time is consumed.

Incision.—Exposure: The incision is made through the skin from the highest palpable part of the thyroid notch to the inferior border of the thyroid cartilage. This small incision is quite ample, because the skin in this region is loose and can be readily accommodated to whatever exposure may be necessary during the operation. Dissection of the skin from the underlying structures is not done. The platysma myoedes, the sternothyroid and the sternohyoid muscle are not in the field of operation. The incision extends down to or through the deep cervical fascia covering the cartilage. An incision is then made in the midline through the perichondrium. An electrically driven rotary saw with a blade of such size as to cut through the cartilage but not into the soft tissues beyond is now used. The lower portion of the thyroid cartilage is thicker than the upper, so that more time and pressure may be necessary to cut through it. It is important to have an assistant drop water along the path of the saw blade to prevent searing and devitalization of the cartilage. The saw cut is rapidly accomplished and produces a

wound with clean edges. After cutting through the cartilage the perichondrial elevator is used to make certain of the separation of the two halves. Then a special three-pronged sharp retractor is slid between

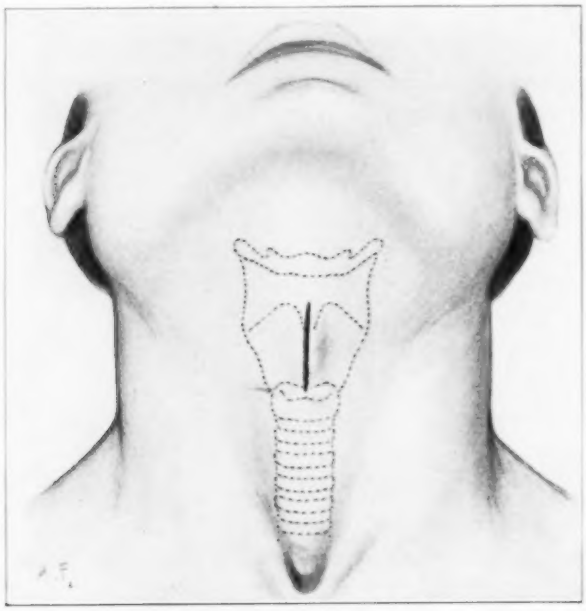

Fig. 1.—Incision through the skin.

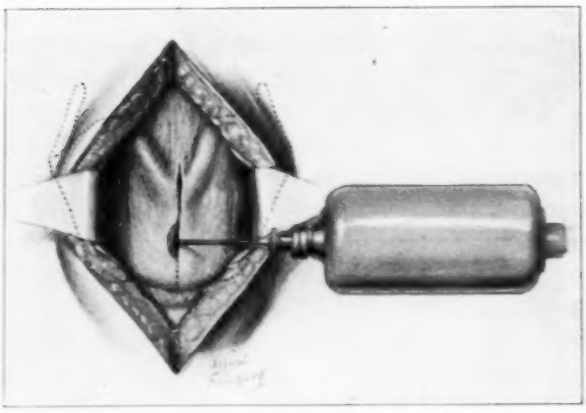

Fig. 2.—Rotary saw powered by a hand motor cutting through the thyroid cartilage.

the alae, and each side is slightly retracted. The prongs are inserted between the inner perichondrium and the cartilage and do not obscure the view or interfere with the instrumentation. This retraction exposes the

soft tissue of the anterior commissure, which is cut through in the midline with a small, sharp knife. After the soft tissues are incised, a special blunt retractor is placed directly over the lateral aspect of the thyroid notch, so that there is no interference with the perichondrial elevation. An adequate exposure of the nature and extent of the carcinoma is thus afforded. It is at this time that the operator must determine whether a laryngectomy only will suffice, or whether excision through this exposure can accomplish the desired result. He must also decide whether the cancer might have penetrated the internal perichondrium to involve the cartilage. If this is so, that portion of the ala which corresponds to the cancerous area and its immediate surrounding

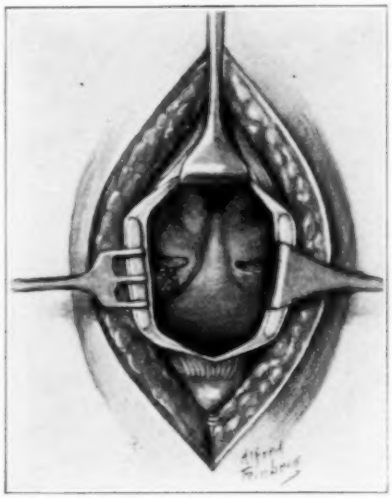

Fig. 3.—Retraction and exposure.

healthy zone will have to be excised. If the disease has not penetrated to the perichondrium or beyond it, the cartilage is not removed.

Removal of part of the alar cartilage was originally suggested by Lack, in 1916. He claimed that it would afford easier retraction and better exposure. That better exposure is afforded by the removal of the cartilage cannot be denied; it has been my experience, however, that the additional exposure is not necessary. The amount of retraction which can be carried out when the cartilage is retained seems to be quite ample for all purposes. Lack stated that the forcible traction on the thyroid alae later causes pain on swallowing. I have not noticed this to be so in my cases. The assertion that the presence of the denuded area of cartilage delays healing may be correct, but this is of minor importance. On the other hand, the statement that removal of the carti-

lage interferes with the normal relations and functions of the larynx is not borne out by my experience. There is a strong impression among laryngologists that after extensive removal of cartilage collapse of the lateral aspect of the larynx may occur. This is not so.

Excision of the Cancer-Bearing Area: When the cartilage is to be removed, a special punch is used which includes the cartilage and all the soft tissues from the mucous membrane of the larynx to the external perichondrium. This punch cuts a rectangular section of the cartilage and laryngeal tissues which measures 24 by 15 mm. If the involved area should require removal of tissue beyond the limitations of the

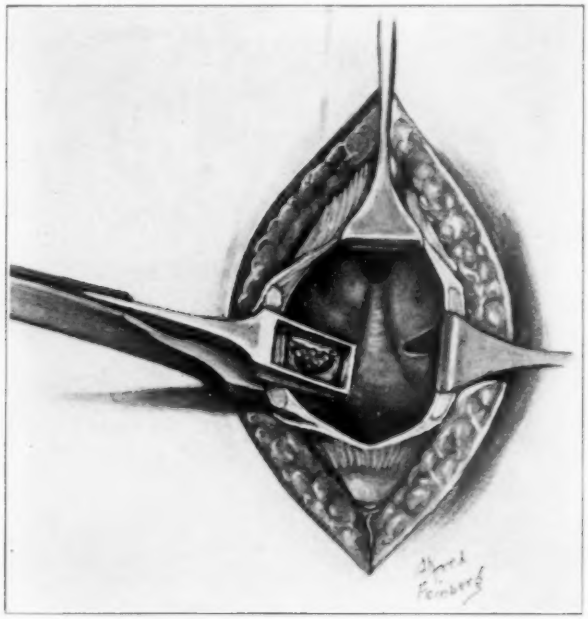

Fig. 4.—Removal of the cancer-bearing area and the cartilage in one piece by means of the special punch.

punch, the cartilage is freed from its internal and external perichondria; the upper and lower margins are separated, and a special angular knife is used to make a vertical section through the posterior portion of the cartilage. Before the soft structures are excised three hemostats are applied. One is placed horizontally at the upper limit of the area and another one at the lower limit. These are to be removed before the straight scissors are used. After incision with the scissors, a right-angled hemostat is applied to the posterior boundary. This step is followed by excision with special angular scissors. The hemostats are left in place for two minutes before the incisions are made.

After the tissue is removed, there is little bleeding. This is carefully controlled by means of small sections of dental roll held by Kelly clamps. Occasionally a vessel situated posteriorly in the severed muscle will bleed. This bleeding is readily controlled by the application of a hemostat, which is left in place for two or three minutes. The branches of the superior laryngeal artery, which supply the posterior part of the

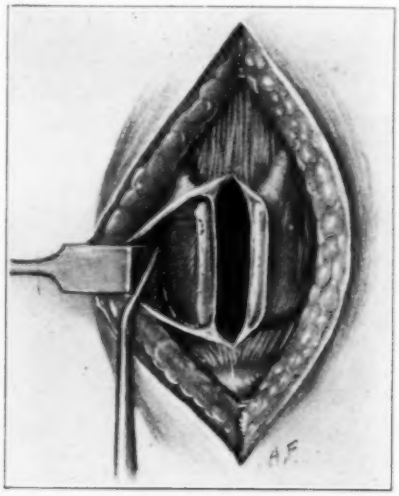

Fig. 5.—Removal of part of the alar cartilage by a special downward cutting knife preliminary to excision of the cancer-bearing soft tissues.

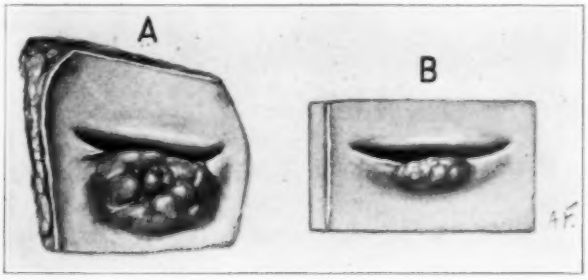

Fig. 6.—*A*, section of tissue excised after removing part of the cartilage with the aid of the downward cutting knife. *B*, section of tissue including alar cartilage removed by the special punch.

larynx, are relatively small; therefore, such procedures as ligation of this artery (Öhngren [15]) or placement of suture ligatures do not seem to be necessary. At times the cancerous growth may have extended

15. Öhngren, G.: Control of Hemorrhage in Laryngofissure, Acta oto-laryng. **19**:452, 1934.

beyond the expected limits. In such instances the diathermy electrode is used, and the remaining surrounding area is desiccated. In some cases it is advantageous to remove a part of the inner aspect of the rim of the cricoid cartilage.

At times the upper part of the vocal band or an overhanging curtain of the lateral fold of the larynx above it protrudes into the air passage. It is best to excise this overhanging tissue so as to avoid interference with breathing.

Closure.—Inasmuch as only the skin, superficial fascia and deep fascia are involved in the incision, skin sutures only are required to close the wound. Two sutures are usually sufficient for this purpose. The lower angle of the wound is left open and a strip of rubber dam

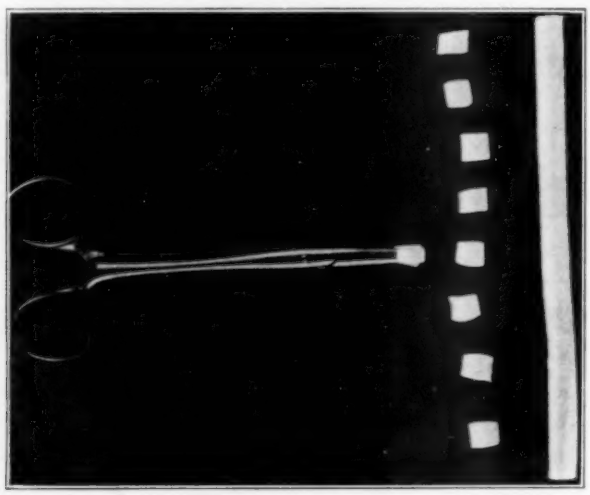

Fig. 7.—Dental roll and sections used for sponging the operative field.

inserted. This prevents subcutaneous emphysema and is removed after twenty-four hours.

For cancer of the area of the anterior commissure the operative procedure of Jackson [16] may be used. In most cases of this kind the patient will have to wear a permanent tracheotomy tube. For localized epiglottic cancer the technic of Tucker [17] is followed. The operation of Tucker was used in a single case of my series.

Postoperative Care.—The patient is returned to bed and placed in a semirecumbent position. On arrival from the operating room he is

16. Jackson, C., and Jackson, C. L.: The Larynx and Its Diseases, Philadelphia, W. B. Saunders Company, 1937, p. 501.

17. Tucker, G.: Total Extirpation of the Epiglottis by the Laryngofissure Route, Ann. Otol., Rhin. & Laryng. **44**:933, 1935.

given a suppository containing 1 grain (0.06 Gm.) of codeine and 10 grains (0.65 Gm.) of acetylsalicylic acid. In my experience this does not interfere with the cough reflex. If the atmosphere of the room is very dry, moisture should be supplied by means of a steam kettle placed at some distance from the bed. Four hours after operation, sterile water is given by mouth, in small quantities. If the patient is able to swallow he can have larger quantities. Fluids can be given at any time after the effect of the anesthetic has worn off. There is usually slight pain, but the patients can swallow despite it. Patients may be permitted to leave their beds on the day following the operation or the day after. They are restrained from speaking for one week after operation. After this they are advised to speak softly and in moderation.

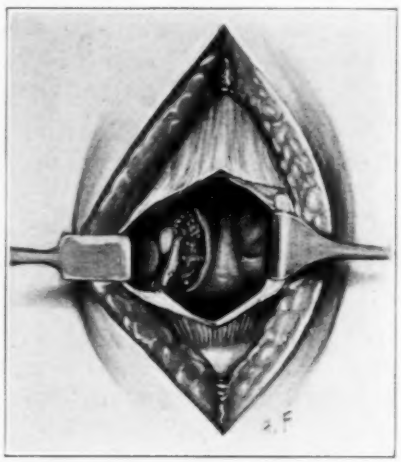

Fig. 8.—Field of operation after removal of the cancer-bearing area.

COMPLICATIONS

Bleeding.—If complete hemostasis is established at the time of operation, postoperative bleeding does not occur. As I have mentioned, if bleeding should occur the wound could readily be opened and the bleeding controlled. If measures other than packing would not suffice, a tracheotomy could be done. In the postoperative care of more than 37 patients such a procedure has not been found necessary.

Reaction of Laryngeal Tissues.—If the tissues are roughly or unnecessarily handled, swelling and edema will ensue, which may compromise the airway. Under such circumstances tracheotomy might become necessary. Tracheotomy will not be necessary if the tissues are handled carefully.

Subcutaneous Emphysema.—Subcutaneous emphysema will occur if the wound is sutured firmly. The lower angle should be left open and a

small strip of rubber dam inserted to permit the air to pass to the outside instead of into the fascial planes. After twenty-four hours the rubber dam can be removed, because at the end of this time these planes are obliterated by healing.

Granuloma.—Granulation tissue occurs in all cases of laryngofissure but in some more than in others. The mere fact of its presence is not an indication for its removal. It is exceedingly rare for a granuloma to become dangerously obstructive. Granulation tissue is a normal product of healing and eventually disappears. It is better not to disturb it unless it interferes with phonation or causes obstruction. One must differentiate between a granuloma and the reappearance of a cancer. If the mass is shrinking one can be sure it is a granuloma; if it is increasing in size, one must suspect cancer. When cancer reappears during the postoperative period, pain in the larynx or pain referred to the ear will be present, as a rule.

Chondritis and Necrosis.—Except in cases in which roentgen therapy has been employed, chondritis and necrosis are uncommon. Attention to the placement of the retractors is important in the prevention of them.

SELECTION OF CASES FOR LARYNGOFISSURE

The extensive resection of cancer of the larynx by laryngofissure is comparatively recent in this country. Experience will enable laryngologists to determine how extensive a lesion can be safely and successfully operated on by this method. I have set the following as the criteria of a cancer which is suitable for laryngofissure and excision:

1. Cancer limited to one side
2. Movement of that side unimpaired
3. No involvement of the arytenoid area
4. No involvement above the ventricular band
5. No involvement below the crest of the cricoid cartilage

SUMMARY AND CONCLUSIONS

Laryngofissure is a relatively simple procedure. No fatalities or severe local reactions should follow the operation. My experience suggests the following observations:

Anesthetization of the larynx before operation is of definite value. A smaller incision than is usually employed will suffice.

Tracheotomy is not necessary. It is conceivable that it might be required on a rare occasion. In such a case the operator would be forewarned and would perform the tracheotomy at the time of the fissure.

Adequate exposure can be obtained without extensive incision of the thyrohyoid membrane and without cutting through the cricothyroid mem-

brane. Retraction of the cartilage gives a sufficient exposure of the interior of the larynx. Removal of part of the thyroid ala for this purpose seems unwarranted. This removal can be accomplished without extensive dissection and exposure of tissues. Elevation of the external perichondrium and of the soft tissues attached to it is readily accomplished by means of an elevator. A long, flat retractor is then inserted, which gives ample exposure. When the disease is fairly limited and the cartilage is to be removed, a special punch may be used, which includes in its bite the soft tissues of the larynx, together with the cartilage. If the lesion is too extensive for the punch, an angular, downward cutting knife is used to section through the cartilage posteriorly, and the soft tissues are excised. Hemostasis is obtained by the use of small sections of dental roll or small intestinal sponges on the ends of fine hemostats. When ordinary pressure with these will not suffice, the application of a hemostat to the bleeding point will control the bleeding. Suture ligatures or plain ties are not used.

Gentle and careful handling of the endolaryngeal tissues is essential to insure a minimum of reaction and obviates the necessity for tracheotomy.

A proper selection of instruments and an orderly sequence insure quick performance of the operation and freedom from complications.

The laryngologist who is confronted with the necessity for performing a laryngofissure need not be too greatly concerned about the procedure, because it is a relatively simple operation.

THROMBOSIS OF THE LATERAL SINUS

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The year 1938 was significant to otologists because on August 18 of that year occurred the fiftieth anniversary of the first successful operation[1] for thrombosis of the lateral sinus, performed by Sir Arbuthnot Lane. The patient was a child with chronic otitis media and mastoiditis on the right and the classic symptoms of septicemia, together with "swollen optic discs," the right being more swollen than the left. At the "second mastoid operation" a necrotic sinus was uncovered, containing pus, which was removed until "quite healthy clot" was obtained. The internal jugular vein was ligated. In a second patient, operated on four months later, no thrombus was found in the sigmoid sinus, and the internal jugular vein was not ligated. This patient died of bronchopneumonia. Thus, at the beginning of operative experience in the treatment of thrombosis of the lateral sinus, the condition was dealt with by two surgical methods—ligation of the jugular vein and nonligation. The question as to which of these gives the better result is still being discussed a half century later.

During the past fifty years diagnostic acumen and surgical and other methods of treatment have been greatly improved, but the clinical picture drawn by Lane remains much the same: Otitis media, mastoiditis, fever, nausea, vomiting, headache or pain in the head, chills and mental or emotional disturbances form the basis for the investigation by laboratory and other methods leading to the diagnosis of thrombosis of the lateral sinus. Fever is the most frequent symptom. Day has pointed out that it may be septic, pneumonic or typhoidal in type. In the present series the septic type appeared approximately six times as frequently as the typhoidal and the pneumonic together. The afebrile thrombosis does not give rise to symptoms and is usually discovered accidentally. Chills appear in the large majority of cases but absence of chills is of no diagnostic importance. Headache or pain in the head is an early and frequent symptom in adults and often in children. For the latter nausea and vomiting are also early and significant. The mental and emotional symptoms are variable both in the same patient

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Read at a meeting of the Southern Section meeting of the American Laryngological, Rhinological and Otological Society, Atlanta, Ga., Jan. 24, 1938.

1. Lane, W. A.: Five Cases of Complicated Diseases of the Middle Ear, Tr. Clin. Soc. London **22**:255-265 (April 26) 1889.

and in a series of patients. Some are comfortable in the intervals between chills; somnolence and lethargy or even unusual alertness may be present; crying, complaining and irritability may be almost constant in others.

Ophthalmoscopic examination shows in most instances tortuosity of the veins and papilledema, usually ipsilateral but frequently bilateral. The Tobey-Ayer otologic application of the Queckenstedt phenomenon demonstrates obliterative thrombosis of the sinus. The test is negative, of course, when phlebitis or mural thrombosis is present. Its sources of error, as pointed out by Tobey,[2] are in the difficulties of a proper technic for patients with thick necks, in the disregard of the normal differences in spinal fluid pressure after separate compression of the internal jugular veins, in the low spinal fluid pressure of some patients, in straining by adults or crying of children and in anatomic anomalies of the lateral sinus and torcular Herophili. These coefficients of error can usually be allowed for, and within the limitations imposed by them the Tobey-Ayer test retains a high value.

The normal anatomic variations of the cranial sinuses are no longer of academic interest to anatomists; they are of clinical concern to otologists. Ersner and Myers[3] initiated the roentgen study of the relations of variations of the lateral sinus to thrombosis. Woodhall and Seeds[4] developed the subject further by correlating roentgenologically the anatomic, clinical and pathologic observations. As a result, progress has been made in recognizing and interpreting the clinical anomalies of the cranial sinuses and the accuracy of the Tobey-Ayer test has thereby increased.

A single blood count is not so valuable as a series of erythrocyte and leukocyte counts with differential and hemoglobin percentages. These are important in diagnosis, in differentiating thrombosis from other conditions and in prognosis. A fall in the erythrocyte count and in the hemoglobin percentage with an increase in the leukocyte count to between 12,000 and 22,000, with an average of 15,000, and a shift in the Schilling hemogram toward the right were regular occurrences in the present series.

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2. Tobey, G. L.: An Attempt at the Differential Diagnosis of Lateral Sinus Thrombosis, Boston M. & S. J. **194**:53-57 (Jan. 14) 1926.

3. Ersner, M. S., and Myers, D.: An Aid to Interpretation of Intracranial Complications Resulting from Venous Circulatory Disturbance of the Temporal Bone, Offered by X-Ray of the Lateral Sinus and Jugular Foramen, Laryngoscope **45**:800-818 (Oct.) 1933.

4. Woodhall, B.: Variations of the Cranial Venous Sinuses in the Region of the Torcular Herophili, Arch. Surg. **33**:297-315 (Aug.) 1936. Woodhall, B., and Seeds, A. E.: Cranial Venous Markings, ibid. **33**:867-875 (Nov.) 1936.

Considerable difference of opinion has been expressed in the literature recently as to the diagnostic value of blood culture in thrombosis. Some consider it of the greatest importance, while others place practically no reliance on it. The interpretation of the result of blood culture is not dependent entirely on the technic employed in obtaining and culturing the blood. An occluding thrombus with practically sterile ends causes no bacteremia, and the blood culture in this event is negative. A positive blood culture demonstrates the bacteremia but not its source, as it may arise from endocarditis, central pneumonia or other infection. But a practically sterile thrombus is exceptional, as is the coincidence of other infections. The approval of a standard technic in obtaining the blood and making the culture would probably heal the differences about the diagnostic value of blood culture.

The clinical picture of thrombosis of the lateral sinus is ordinarily not difficult to recognize, but, as the numerous tests indicate, sometimes it is most confusing. The differential diagnosis from other infections capable of producing septicemia is largely a process of elimination. The methods employed in distinguishing the condition from pneumonia, pyelitis, meningitis, endocarditis, malaria and brucellosis are too well established to require any additional comment. One patient in the series was shown to have Plasmodium vivax in the blood (tertian malaria) coincident with the thrombosis. Incidentally, the administration of quinine to this patient had no effect on the septicemia. Another patient, not included in the series, whose blood gave agglutination of Brucella melitensis in high titer (undulant fever, or brucellosis), presented a clinical picture closely simulating that of thrombosis of the lateral sinus, including both bilateral acute suppurative otitis media and acute arthritis.

The consensus on the pathologic aspects of thrombosis of the lateral sinus is fairly uniform except on the question of an extension of the thrombus. Coates, Ersner and Persky [5] have graphically described the extravenous extension of infection within the mastoid resulting in periphlebitis or perisinal abscess and in the formation of a thrombus. The intravenous extension from smaller to larger veins finally reaches the sinus, with first a mural and later under certain conditions an obliterative thrombus. Others have expressed the view that phlebitis involving the wall of the sinus may lead to the formation of a thrombus or spread along the intima without formation of a thrombus. A review of the literature available to me eleven years ago, in which the location of the thrombus was specified in 426 cases, showed the thrombus in the lateral sinus and jugular bulb in approximately 31 per cent of the cases, in the

5. Coates, G. M.; Ersner, M. S., and Persky, A. H.: Lateral Sinus Thrombosis with a Review of the Literature, Ann. Otol., Rhin. & Laryng. **43**:419-440 (June) 1934.

sigmoid sinus in 31 per cent and in the jugular bulb in 13 per cent. In 25 per cent no thrombus was present. A thrombus in the latertal sinus and jugular bulb—which occurred in 31 per cent of the cases reported in the literature—might extend from the torcular Herophili through the bulb, but more frequently one thrombus was reported in the sigmoid sinus and another in the bulb. Considerable discussion at the present time concerns the mechanics of the extension of the thrombosis. Some state that the formation of the thrombus is largely retrograde, with a few authors holding that it is exclusively so. Others report that the infection in the intima can spread either proximally or distally, and the statistics and other data which they present rather bear out this view.

Surgical treatment of thrombosis of the lateral sinus seeks to convert a systemic infection, or septicemia, into a local infection. While for no other condition are operations so modified to meet individual requirements as for thrombosis, yet operations for the latter may be classified into three main groups: (1) operation on the sinus, (2) operation on the sinus with ligation of the internal jugular vein and (3) the Panse-Gruenert operation for resection of the jugular bulb. The latter operation is popular in Europe but is rarely reported in this country. The surgical procedure for a number of years has been to operate on the sinus and ligate the internal jugular vein, unless there were indications to do otherwise. One of these indications is a thrombosed internal jugular vein, which is resected throughout the extent of the thrombosis or to the clavicle. Indications for operation on the sinus alone have been stated by Kopetzky [6] to be the absence of a thrombus in the sigmoid sinus and a negative blood culture accompanying a thrombus. An increasing number of otologists during the past five or six years have expressed dissatisfaction with the results obtained by ligation of the jugular vein, some even condemning it as contraindicated. So impressive have been the statistics and other data of the otologists advocating operation on the sinus alone that the relative merits of ligation and nonligation of the jugular vein are again brought up for review. Richards [7] succinctly presented the case against ligation as follows: Obliterative thrombosis occurs without giving evidence of its presence; pyemia appears not infrequently after ligation of the jugular vein; there is a question whether ligation reacts as retrograde thrombosis through collateral intracranial circulation by increasing the tendency to meningitis and abscess of the brain; no complication or fatality occurred in his last 6 consecutive cases, in which he operated on the sinus alone.

6. Kopetzky, S. J.: Acute and Chronic Otitis Media, Sinus Thrombosis and Suppuration of the Petrous Pyramid, Arch. Otolaryng. **22**:336-357 (Sept.) 1935.

7. Richards, L.: The Pros and Cons of Jugular Ligation in Lateral Sinus Thrombosis, Kentucky M. J. **33**:351-354 (Aug.) 1935.

Impressed by this and other excellent reports, my associates and I reviewed our cases and considered the advisability of changing our usual surgical procedure. Without adopting the role of either a "ligationist" or a "nonligationist," one may observe that the jugular vein is ligated with four objects in view: first, to prevent entrance of emboli into the lungs as infarcts from the proximal end of the thrombus as it is being removed from the sigmoid sinus (a personal communication from a distinguished otologist recounted his experience of twenty years ago in which the proximal end of the thrombus slipped away from his curet through the jugular bulb and vein, with the instant death of the patient); second, to protect against the possibility of a mural thrombus in the jugular bulb becoming an embolus; third, to demark positively the limit of the proximal extension of the thrombus in the internal jugular vein and if the vein is thrombosed to resect it, and fourth, to defend against secondary bacteremia. The ligation of the jugular vein seems to be effective in comparable cases of thrombosis in which operation is done reasonably early, but when the condition is advanced, chills occur frequently after ligation. Also, when the invading bacteria are unusually virulent ligation has little effect on the sepsis.

During the past eight years, my associates [8] and I have performed 518 mastoidectomies on private patients, 16 of whom, or 3 per cent, had been given the diagnosis of thrombosis of the lateral sinus. Males were affected in 9 of the cases of thrombosis and females in 7. The condition accompanied, or appeared as a postoperative complication in, acute mastoiditis in 11 patients and chronic in 5. Children were affected in 10 cases and adults in 6. Mastoidectomies were much more frequent in children than in adults, and acute mastoiditis was more frequent than chronic. The right sinus was affected in 11 cases and the left in 5.

Our method of treatment of thrombosis has been fairly uniform during the past eight years and consists surgically of operation on the sinus with ligation of the jugular vein except for resection of the vein when it has been thrombosed. In performance, the sigmoid sinus is regularly uncovered first, because periphlebitis or perisinal abscess cannot be differentiated preoperatively from thrombosis. A small incision is made through the wall of the sinus. (In 14 cases a thrombus has been present and in 2 there has been no thrombus.) The internal jugular vein is then exposed, ligated below the tied facial vein and cut between the ligature. A drain is placed between these ends and the wound closed. The sinus is exposed distally by the removal of bone until free bleeding occurs and proximally until either free bleeding appears or the course of the sinus toward the jugular bulb is straight. The

8. Drs. John H. Foster, Lyle J. Logue, J. M. Robison and George F. Mood.

proximal thrombus toward the jugular bulb is removed by suction—a method introduced by Day. No difference has been observed in results between trimming off the external walls of the sinus and merely packing the sinus open. Bleeding is controlled by rolls of iodoform gauze, the size of a pencil, packed between the cranium and the sinus. If no bleeding occurs from the proximal opening of the sinus it is left patent and irrigated daily. The packs are removed on the fifth day, usually with the patient under a general anesthetic.

In 3 cases the right internal jugular vein was thrombosed partially or completely; in 2 the jugular vein was resected from slightly below the bulb to the clavicle and in 1 to below the omohyoid muscle. In 1 of these cases right cavernous sinusitis developed. The eye was promptly removed, with considerable subsequent drainage. The patient recovered. The resection of the internal jugular vein, the operation on the sinus with removal of the thrombus and the enucleation of the eye were considered important factors in her recovery. In the second case the patient had a pulmonary infarct from the torcular Herophili, with the development of an abscess of the lung. He returned four years later with an abscess of the temporal lobe. This was drained and packed with a rubber strip, and the patient recovered. In the third case meningitis developed, with a spinal fluid cell count of 6000. The patient was treated with continuous spinal drainage and continuous intravenous infusion of hypotonic saline solution. He recovered.

Four of the 16 consecutive patients died, a mortality of 25 per cent. One of these was admitted to the hospital with advanced meningitis and died within forty-eight hours. This patient will be omitted from further statistical consideration, the mortality thus being 20 per cent. Necrosis of the wall of the sinus was demonstrated at operation in 5 patients, and 2 died. No thrombus was found in 2 patients, and 1 died. A thrombus was present in 13 patients—3 adults, of whom 1 died, and 10 children, of whom 1 died. The thrombosis accompanied or was postoperative to acute mastoiditis in 11 patients, of whom 2 died, and occurred with chronic mastoiditis in 4, with 1 death. The sixth cranial nerve was affected in 2 patients; in 1 the paralysis was ipsilateral to the thrombosis and in 1 contralateral. Both recovered. An analysis of our records shows that thrombosis was manifest in 7 cases, latent in 5 and postoperative in 3. The operation on the sinus was done at the same time as the mastoidectomy in 7 patients, of whom 2 died, and after the mastoidectomy in 8, of whom 1 died.

The development of blood transfusion as a therapeutic agent had three stages. The first was its use to remedy the secondary anemia from sepsis. The next was the realization that the donor's blood contained sufficient antibodies in some instances to affect the virulence of the invading organism. The third was the effort to increase the amount of

available antibodies, either by immunizing the donor or, more simply, by increasing the number of transfusions. We have attempted to increase the amount of antibodies merely by increasing the number of transfusions. A rather small amount of blood is used in the transfusion, to stimulate leukocytosis. The first transfusion is given immediately after the operation and the second at a three day interval. The amount of blood transfused varies from 150 to 250 cc. It is important that the blood of the donor, even the same donor, be typed before each transfusion. A transfusion given before operation has no effect on the course of the disease, but one given after the operation is sometimes beneficial.

With the advent of sulfanilamide the chemotherapy of thrombosis of the lateral sinus was placed on an entirely different plane. Kemler [9] reported that the symptoms of septicemia noted before operation are completely controlled during the administration of sulfanilamide and for five to seven days after it is used, but that chills and fever then recur. In the last case in our series a blood transfusion was employed forty-eight hours after operation without any effect on the sepsis. Sulfanilamide was then used, and the temperature fell by lysis and remained normal after three days. No conclusion can be based on 2 cases except that the early postoperative use of sulfanilamide presents the possibility of a brilliant and uneventful recovery from a streptococcic infection of the blood stream.

No more fitting celebration could be devised for the fiftieth anniversary of Lane's operation than the confirmation of every otologist's hope that in sulfanilamide a remedy has at last been found which is capable of still further reducing the mortality from thrombosis of the lateral sinus.

1304 Walker Avenue.

9. Kemler, J. T., in discussion on Ersner, M. S., and Myers, D.: Treatment of Thrombosis of the Lateral Sinus, J. A. M. A. **109**:919-923 (Sept. 18) 1937.

RHINOSCLEROMA

REPORT OF A CASE

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ELIZABETH, N. J.

Rhinoscleroma is a chronic granulomatous process which affects the nose, the adjacent mucous membranes and sometimes the adjacent skin.[1] It was named rhinoscleroma by Hebra in 1870, who described the first case.[2] In 1882 von Frisch [3] described the organism which is said to be the causative agent. Other names have since been given to the disease, viz., rhinopharyngoscleroma, scleroma respiratorium and scleroma.[4]

GENERAL CONSIDERATIONS

Distribution.—The disease, though rarely observed in this country, has been the subject of much writing in Europe, and many excellent articles have appeared in other parts of the world, including America. It is most prevalent along the banks of the Danube in Central and Southeastern Europe, i. e., in Poland, Hungary, the Balkans and the Ukraine. In 1929 a series of 500 cases was reported from Kiev, in the Ukraine.[5] The disease has been reported sporadically in Southern and Western Asia, Northern Africa, Australia, Japan, Sumatra, Central America, Mexico, South America, the United States and even Canada. In San Salvador almost 300 cases have been observed by one author.[6] Most cases have been observed among the Poles, Russians, Austrians and others inhabiting the first-mentioned regions. Occurrences of the condition have been described in Italy.[7] Those reported in England and France have been in immigrants from Central Europe. The same is

1. Karsner, H. T.: Human Pathology, Philadelphia, J. B. Lippincott Company, 1926, p. 262.

2. Hebra: Ueber ein eigenthümliches Neugebilde an der Nase; Rhinosclerom; nebst histologischem Befunde vom Dr. M. Kohn, Wien. med. Wchnschr. **20**:1-5, 1870.

3. von Frisch, A.: Zur Aetiologie des Rhinoskleroms, Wien. med. Wchnschr. **32**:969-972, 1882.

4. Figi, F. A., and Thompson, L.: Rhinoscleroma, J. A. M. A. **91**:637-643 (Sept. 1) 1928.

5. Putschkowsky, A.: Changes in the Organism Accompanying Scleromata in the Upper Respiratory Tract, Acta oto-laryng. **32**:543-551, 1929.

6. Reyes, E., cited by Ireland.[18]

7. Lasagna, F.: Infective Scleroma of the Resiratory Passages, J. Laryng. & Otol. **40**:369-373 (June) 1925.

true of occurrences reported in this country with the exception of a few affecting Mexicans and natives. The patients had come from Europe with the infection already present, and it was recognized only at a subsequent period. By February 1936 a total of 46 cases had been reported in the United States.[7a] Five of the patients were born in the United States; 4 of these 5 were of foreign parentage. The first case of primary scleroma in a native American was reported in 1921. The patient was a Negro born in Maryland, and the condition was diagnosed at autopsy.[8] The first case of primary scleroma in a native American diagnosed as such during life was presented at a meeting at the Mayo Clinic in 1928. The patient was a white man aged 26, born in New Jersey of Slavic parentage. A comprehensive paper on the subject was read before the Section on Laryngology, Otology and Rhinology at the Seventy-Ninth Annual Session of the American Medical Association, in Minneapolis, on June 14, 1928. The authors stated that only 6 cases of scleroma, proved to be such, had been observed in the Mayo clinic during the eight and one-half years prior to the writing of their paper. Lewis [9] reported 2 cases in which the condition occurred in native-born Mexicans. There were other excellent papers on the subject by Toeplitz, Kreuder, Watkins, Guntzer, Mayer and Freeman. Cases have been reported in California,[10] Ohio,[11] New York,[12] Canada,[13] Michigan [14] and Mexico.[15] In Central America the condition is more frequent, even common, among the poorer classes.[16]

7a. Since the writing of this paper 3 additional cases of scleroma have been reported in California, by L. F. Morrison (Scleroma, Arch. Otolaryng. **4**:531-537 [Oct.] 1938).

8. Watkins, S. S.: Primary Scleroma of the Larynx in a Negro Born in Maryland, Surg., Gynec. & Obst. **33**:47-52 (July) 1921.

9. Lewis, E. R.: Clinical Reports Showing the Value of Systemic Treatment: Two Cases of Rhinoscleroma, Tr. Am. Laryng., Rhin. & Otol. Soc. **38**:459-466, 1932.

10. (*a*) Alderson, H. E.: Scleroma: Report of a Case, Arch. Dermat. & Syph. **26**:639-643 (Oct.) 1932; (*b*) Scleroma in California, California & West. Med. **47**:317-321 (Nov.) 1937. (*c*) Bingham, E. M., and Cutler, O. I.: Rhinoscleroma, ibid. **42**:463-464 (June) 1935.

11. Chamberlin, W. B.: Rhinoscleroma—Is It an Indigenous Disease? Arch. Otolaryng. **23**:285-294 (March) 1936.

12. Schwartz, A. A.: Rhinoscleroma: Report of Two Cases, Arch. Otolaryng. **21**:199-204 (Feb.) 1935.

13. Ireland, P. E.: Rhinoscleroma—with the Report of a Case, Canad. M. A. J. **34**:149-152 (Feb.) 1936.

14. Canfield, N.: Case of Rhinoscleroma in a Native Born American, Ann. Otol., Rhin. & Laryng. **42**:903-908 (Sept.) 1933.

15. Peter, G.: The Treatment of Rhinoscleroma with Roentgen Rays, Radiology **27**:367-370 (Sept.) 1936.

16. Reyes, E., cited by Alderson.[10b]

Incidence.—The disease occurs mostly in early adult life although cases have been described of patients who ranged in age from the first to the fifth decade. Figi and Thompson stated that in Baurowicz' series of 100 cases only 13 patients were beyond the fourth decade; the oldest was 63, and the average age was 25.7 years. Their own 6 patients at the Mayo Clinic were from 26 to 35 years of age, and all were men. The condition is said to be more common in women than in men; there were 57 women and 43 men in the Baurowicz series. Poverty and especially lack of cleanliness are important factors. In Europe the condition is found mainly in the rural districts, where it is endemic. In San Salvador most of the victims were workers with aniline dyes, and the flies, which were plentiful about the fermentation tanks, were suspected as a possible vector. No connection was established, however, except that after the factories closed down there was a marked drop in the number of cases. That the disease is contagious is borne out by the reported instances in more than one member of the same household, family or vicinity and the fact that it is endemic in certain districts. The insidiousness accounts for the fact that the patients cannot remember contact with any one who had the same disease; apparently a good many years elapse between infection and the appearance of symptoms that send the victim in search of medical attention. Often, the patients go without diagnosis of their condition or are treated for entirely different ailments over long periods. When first described in 1870, the disease appeared to be limited to the Balkan states in Europe. Apparently the increase in travel facilities and the migration of the poorer classes of people from these areas in the effort to better their economic condition had much to do with the appearance of this disease in other parts of the globe.

History and Symptoms.—The onset of the disease is insidious, and the patient is unable to state when or where it occurred or whether or not there had been contact with some one who had the disease. In most cases no history of contact can be obtained even when the patient is intelligent. It may be ascribed to an injury sustained at one time or another, or an attack of acute coryza may first call attention to a series of symptoms related to the nose or other parts of the respiratory tract. From the beginning, often for many years, there are no symptoms except possibly a slight, chronic watery or purulent discharge from the anterior or posterior nares. Gradually there are various degrees of obstruction of the nasal passages. The symptoms are generally referred to the nose at first and then to the nasopharynx, the pharynx, or the larynx, according to the location and degree of involvement. Many have been treated for tuberculosis, syphilis or other acute or chronic conditions of the upper part of the respiratory tract even in spite of one or repeated negative Wassermann, tuberculin and other tests.

Gross Pathology.—The first lesion is generally said to be a nodule or swelling about the mucocutaneous junction of the anterior nares. This may or may not ulcerate and spread, with time, in both directions. The nose may become broadened or flattened or both at the cartilaginous portion beneath the bridge (fig. 1). The bony structures apparently are not involved; the disease seems to have a predilection for the mucous and submucous tissue of the upper part of the respiratory tract and adnexa, the changes in the mucosa appearing to be dependent on those in the submucosa. The process may be confined to the site of primary involvement for some time or, as is more common, it may spread in both directions. Cases have been described in which the nasolacrimal duct and the lacrimal sac, with the canaliculi, and that portion of the lids at the inner canthus, were involved. Obstruction to nasal breathing is

Fig. 1.—Photograph of the nose to show distortion because of broadening at the level of the nasal processes of the maxillas.

fairly constant; constriction and stenosis of the nasopharyngopharyngeal aperture is common, and tracheotomies have been performed to relieve dyspnea produced by stenosis of the larynx caused by this disease. The disease process runs a chronic course, and, according to some, subsides spontaneously after twenty or more years. Aching and soreness may be present, though they are uncommon, and pain is rare. In the cases of laryngeal involvement hoarseness and loss of voice come on slowly, with cough and sometimes dyspnea requiring emergency measures. Involvement of the regional lymphatics has been mentioned but no report has been found of positive results from biopsy or culture (fig. 2). Gastrointestinal involvement has been described. Some writers divide the disease into three stages, viz.: (1) the catarrhal stage, (2) the stage of tumefaction and (3) the stage of cicatrization. Various other symptoms may be present according to the duration and extent of the lesion and the anatomic structures involved. Death is said never to result from

the scleroma itself, although a case is mentioned in which death was due directly to the scleroma.[4] The duration of the symptoms prior to diagnosis varies; in the Mayo series it averaged four and one-half years and ranged from one to eight years. The appearance varies with the duration and extent of involvement and the latter with the virulence; in some cases the condition is more chronic than in others. There may be no inkling as to the diagnosis except from biopsy and culture. Clinically

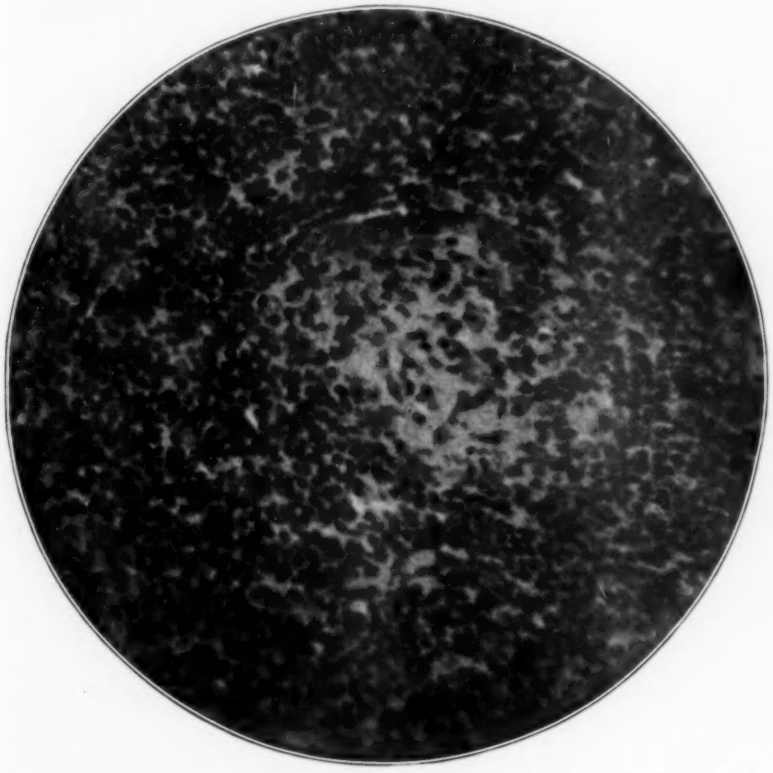

Fig. 2.—Low power magnification of a section of the lymph node excised from the neck, showing a lymph follicle and absence of the characteristic picture of the disease. Cultures of the gland were sterile.

the process may simulate syphilis, tuberculosis, leprosy, atrophic rhinitis or even sarcoma or carcinoma.

In the throat there is destruction of the pillars, tonsils, uvula and soft palate, and the nasopharynx gradually becomes obliterated (fig. 3). The uvula may be drawn upward by cicatricial bands and thus appear to be cut off, or it may be drawn downward. When the palate is involved the alveolar arch may become enlarged and cause a wide

separation between the teeth. With extension of the infection downward, the larynx undergoes similar changes; there is swelling, with scleromatous changes later and then concentric stenosis. There may be large hard tumor-like masses, which may or may not break down and ulcerate, resembling malignant or tuberculous tissue. A case has been reported [13] in which tracheal changes were caused by the disease, and another [4] in which bronchial involvement was suspected.

Microscopic Alterations.—The sections present a not entirely characteristic microscopic picture. Scleroma must be borne in mind; else

Fig. 3.—Photograph showing destructive changes in the pharynx. The uvula appears to be cut off, and the palatine pillars and remnants of tonsils adherent to the posterior pharyngeal wall appear to obliterate the lateral recesses. The opening from the nasopharynx to the oropharynx measured 5 by 8 mm.

confusion may arise.[17] There are, however, characteristics which permit differentiation from similar chronic granulomatous lesions. Careful study will permit exclusion of certain of these, and positive findings not present in others help to establish a correct histologic diagnosis. In the early stages there is transudation of fluid in the submucosa, round cell infiltration and organization, with formation of fibrous bands, and plasma cell infiltration. There are then large extents of organized granulation tissue, filled with cellular products of inflammation. The

17. Diederich, O. P., in discussion on Alderson.[10b]

inflammatory process is low grade; the cellular content shows little nuclear fragmentation, and there are no areas of coagulation necrosis as in syphilis, tuberculosis and malignant conditions. There are large areas of the foam, or Mikulicz or "lace," cells, which measure from 100 to 200 microns and contain usually one or more nuclei (fig. 4). The cytoplasm seems absent, and in the cell body are granules and a delicate

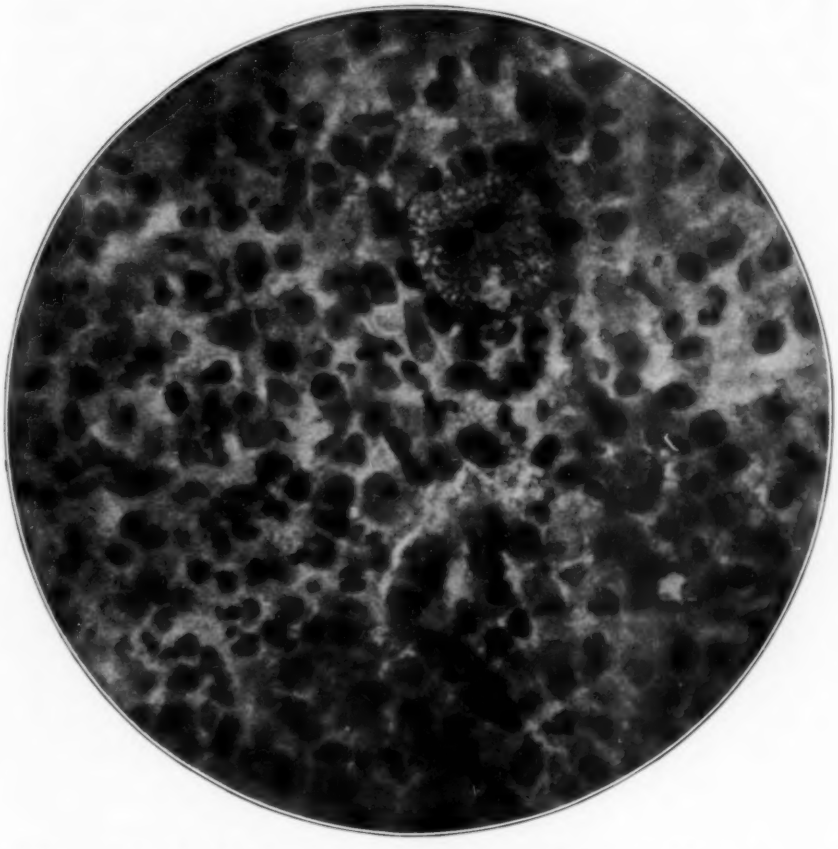

Fig. 4.—Section showing a Mikulicz, or foam, cell with double nucleus and fairly well preserved reticulum. The size of the cell can be estimated by comparison with the surrounding lymphocytes and fibroblasts. The nuclei of the cell are each approximately the size of the large lymphocyte.

network, which give the areas a lacelike appearance. Large numbers of Frisch bacilli are found within these cells, scattered, not clumped as in leprosy. The cells are most numerous just beneath the epithelium and numerically preponderant in the older lesions (figs. 5 and 6). They are said to be degenerative forms of the mononuclear leukocytes. Besides

these and the round cells, many eosinophils are scattered throughout the section, as are also larger or smaller globular bodies, about 20 to 40 microns in diameter, hyaline and staining deeply with acid dyes. They contain no bacilli. These are the Russell, or Unna, bodies. As the lesions become older, fibrous tissue gradually replaces the cellular elements; vascular and lymphatic channels are gradually occluded; the nutrition is impaired, and the mucosa atrophies.

Bacteriology.—The bacillus of scleroma is a short rod-shaped bacillus, motile, gram-negative, possessing a capsule in tissue sections and in cultures and said to resemble the Friedländer bacillus type III. The

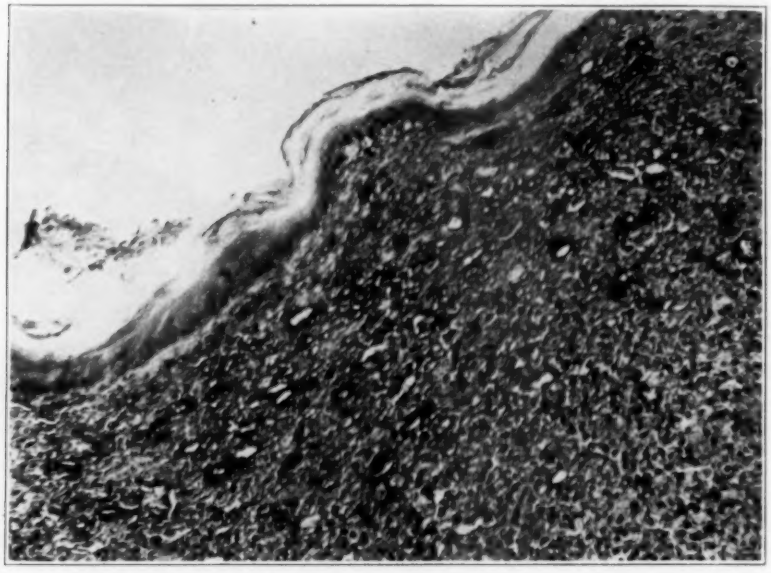

Fig. 5.—Low power section from the pharynx to show the large numbers of Mikulicz cells beneath the mucosa. Most of the cell contents have been washed out in preparation of the slides.

colonies are gray; the organism does not coagulate milk, does not ferment sugars, grows easily on various mediums and is less pathogenic for animals than the Friedländer and similar encapsulated bacteria.[18] Infection is said to be by direct contact and the organism an obligate parasite.

Diagnosis.—The history, the clinical and laboratory data, the biopsy and the culture give the diagnosis. The birthplace and the family history are important. The Wassermann and the tuberculin test, as well as the

18. Goslings, W. R. O.: Scleroma Respiratorium: Biochemical Cultural Properties of Scleroma Strains in Comparison with Other Encapsulated Bacteria. Zentralbl. f. Bakt. (Abt. 1) **133**:33-49 (Nov. 20) 1934.

roentgen examination, are helpful in exclusion, although two diseases could coexist.[19] The simple inflammatory conditions are ruled out by the nature of the process. Even after biopsy and culture the diagnosis may be missed if not borne in mind. Cutaneous reactions and agglutination tests are said to be of value.[20]

Treatment.—The roentgen ray and radium offer the best means of treatment at the present time. The disease had been considered incurable

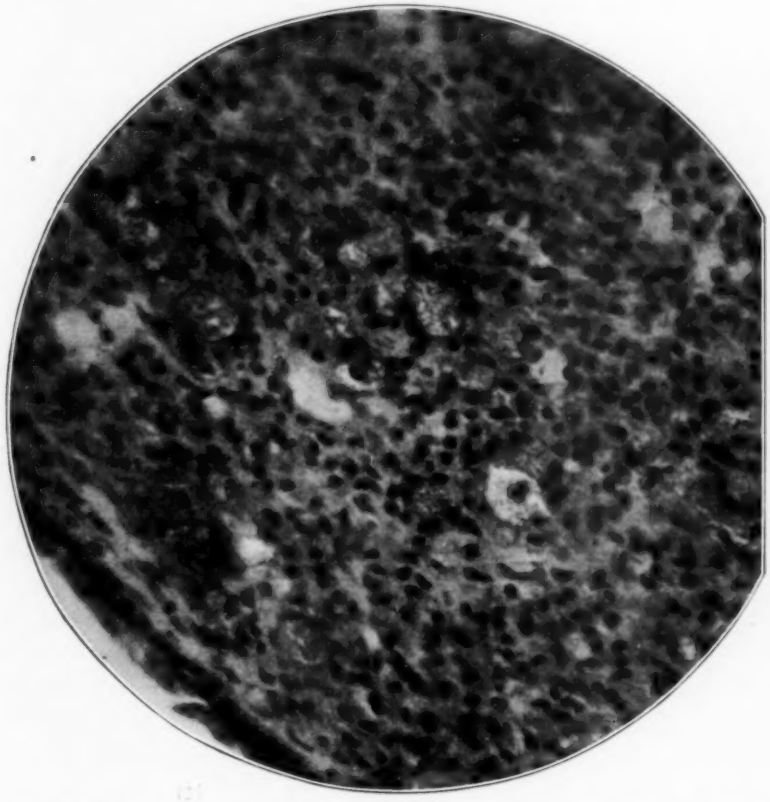

Fig. 6.—High power section from the nose showing numerous Mikulicz cells beneath the mucous membrane, scarcity of vascular structures and replacement by fibrous tissue.

until Fittig reported on treatment with the roentgen ray, in 1903. Since that time the technic has been improved and various methods and dosages devised, with excellent results in the individual cases. In 1936

19. Kernan, J. D., in discussion on Chamberlin.[11]

20. Mucha, V.: Rhinoscleroma: Diagnosis, Bacteriologic and Serologic, Bratisl. lekár. listy **15**:1015-1022 (Sept.) 1935.

Gustav Peter published his method, used in a series of cases with satisfactory results cosmetically and as regards prognosis.[15] In some of his patients the lesions were far advanced. Radium was used with good results in the Mayo series, along with potassium iodide to loosen the secretions. All agree that the patients should be kept under observation for long periods. Autogenous vaccine is said to be of benefit in the early stages and in preventing spread of the disease. It has no effect on the old sclerotic areas. Fever therapy and attacks of erysipelas and typhus have been found beneficial. Surgical removal of diseased tissue, with cautery of areas showing recurrence, has been reported to have cured; on the other hand, it has been stated that surgical procedures of any kind are contraindicated except possibly removal of tissue for biopsy or tracheotomy or other emergency measure.[12] Excision, diathermy and galvanocautery, in conjunction with suitable mechanical expanding pressure, have been advocated.[21] Treatment with mercury, arsphenamine, iodine, tuberculin, local applications of a caustic and cautery produced poor results or none at all. Hassan Bey Shaheen [22] reported successful treatment with colloidal iodine even in cases in which radium had been used unsuccessfully.

Prognosis.—The extent of the disease and to a lesser degree the general condition of the patient have much bearing on the prognosis. Patients whose lesions are in the early stages, with involvement of only the nose or of the nose and pharynx, do well; when there has been extension into the larynx and trachea for some time, often necessitating emergency measures, the outlook may be poor, at least until the emergency is passed. Even in the latter circumstance persistent treatment is said to offer a fair chance of recovery, especially the employment of frequent prolonged small doses of radiation with supportive measures. The duration of the treatment varies with the stage of the disease and the method of handling. Old sclerotic areas respond more slowly than recently involved ones. The use of low doses over a prolonged period at intervals long enough for all reaction to subside prevents the fibrinous mucositis that follows higher doses and shorter intervals. Radium has generally been used to dispose of localized lesions in the nose, gums and pharynx. The ulcerated areas heal and disappear; the nasal fossae regain some patency; the odorous discharge disappears, and in cases of laryngeal involvement the obstruction to breathing is relieved. Though a

21. Dobrzański, A.: Clinical Aspect and Therapy of Rhinoscleroma, Polska gaz. lek. **12**:700-703 (Sept. 3) 1933; abstracted, J. A. M. A. **101**:1440 (Oct. 28) 1933.

22. Shaheen, H. B.: Collosal Iodine in Oto-Rhinology, J. Laryng. & Otol. **43**:496-498 (July) 1928.

complete return to normal cannot be expected, because of the permanent changes often present, the progress of the disease is arrested by roentgen therapy, and the symptomatic improvement and changes in appearance are marked. The patient, if kept under observation, can be made comfortable and able to go about his duties.

PRELIMINARY REPORT OF CASE

Miss A. Z., aged 26, white, was first seen in April 1938, complaining of nasal deformity, discharge and obstruction, with concomitant secondary symptoms. There were no headaches, pains or swellings. The history was indefinite. The onset was placed four to five years back, when the patient had a "bone removed from her nose" by an otorhinolaryngologist because of obstruction. She was then treated for some months with drops and sprays, with no relief. She was treated similarly by another physician, with similar results, up to 1936; at that time, because of lack of funds, she was referred to the local clinic where she was first seen by me. In December 1937, in another city, a simple mastoidectomy was done on the left side, after which she made an uneventful recovery. Her clinical record showed that she had been treated for various diseases, ranging from chronic simple catarrhal rhinitis to syphilis and tuberculosis of the nose and throat. At no time was a biopsy or culture of material from the nose done. The record in September 1936 described an attack of pleuritis which cleared under systemic treatment. It was recorded also that the Wassermann reaction, blood count, sputum, urine, bleeding time, clotting time and roentgen observations on the head were normal or noninformative. She reported a temporary improvement in breathing following the roentgen examinations. After a cursory examination of the nose and throat, the aforementioned factors being borne in mind, the nature of the condition was suspected, and the patient was sent to the wards of the hospital with a note asking that the nasal secretions be cultured and a biopsy made. She was discharged after three days of treatment, which consisted of instillation of some watery drops three times a day. The requested culture and biopsy were not made. Under the circumstances and at her own request she came to my office one week later.

History.—More careful inquiry into her personal and family history elicited the information that when a child of approximately 10 years she had lived with another girl of the same age, at the home of a neighbor for approximately four years. The neighbor's family consisted of the father, mother and 2 children, probably 8 and 10 years of age at the time. A frequent visitor in the home of this family was another neighbor, a man who had difficulties with his nose, consisting mainly of obstruction to nasal breathing and speech with a nasal twang. Most vivid in the patient's recollection of this man was the fact that the alae nasi and the upper lip about the attachment of the alae were enlarged as by a tumor, ulcerated and covered with scales and crusts. She remembered an almost constant odorous discharge from the visitor's nose and the involved area. She had no direct personal contact with him that she could recollect. The girl with whom she shared the room and the family with whom she lived have been lost track of, and attempts to communicate with them by mail have been unsuccessful up to the present time.

The patient was born in the southern part of Poland and lived there until the age of 18, when she came to this country. Her only immediate relative in this

country is a brother, who came to America with her but whose whereabouts for the past five or six years are unknown to the patient. She lives with an aunt and 4 cousins, who have no symptoms referable to the nose and throat. The aunt and her husband have resided in this country for the past twenty-seven years. Three years prior to entering the United States the patient was examined and treated for a nasal complaint. No diagnosis was given. She made but one visit, at which time she was supplied with some powders to take by mouth and told she would not need to return. At the same time she had approximately six "boils" on the left side of the neck, which ruptured and healed spontaneously over a period of eight months under treatment with hot poultices. From regular correspondence with her family in Europe, she has learned that her parents, 4 brothers and 5 sisters are well and have no complaints referable to the nose and throat.

Examination.—The patient was a woman of average proportions, 5 feet 2 inches (157.48 cm.) tall and weighing 105 pounds (47.6 Kg.), with good stature and with no striking findings on simple inspection. Her speech, however, was that characteristic of patients with nasal obstruction. The cartilaginous portion of the nose was broad at the base and flattened immediately beneath the bridge, giving it a saddle appearance. The columella was approximately twice the normal thickness and the nares small and contracted, mostly at the limen nasi, with the right stenosed almost completely and the left admitting only the tip of a small nasal speculum. Beyond the stenosis on the left side the nasal fossa was completely filled with a granulomatous mass, which was hard, red and rough with fairly uniformly pinhead-sized nodules, not especially tender to touch. No definite anatomic landmarks could be made out; the turbinates seemed to be matted together, and thick formations of crust filled in all but a small passage on that side. The right nasal fossa remained completely obstructed even after removal of crusts and as much shrinkage as could be attained with cocaine and epinephrine. The response to shrinkage was slight. In the throat the anterior and posterior pillars, the uvula and the soft palate were matted together with the postpharyngeal wall, obliterating the lateral pharyngeal recesses and partly the nasopharynx. The uvula seemed to be cut off at the base. The tonsils were almost absent. With the help of the laryngeal mirror it was found that the uvula projected upward and was held by cicatricial bands to the posterior wall of what remained of the nasopharynx. The details in the nasopharynx could not be made out nor could the posterior border of the septum and the eustachian orifices. The hypopharynx was narrowed markedly; it was granular and red and covered by thick mucopus. The epiglottis, the arytenoid cartilages, the folds, the upper strait of the larynx, the true and the false vocal cords did not appear abnormal in any way. The vocal cords were freely motile, their action good and the glottic chink ample. Each ear drum appeared thickened and adherent to the medial wall of the middle ear. There was a small central circular scar on the left drum, apparently from previous perforation. The left mastoid area showed a well healed scar. Hearing was good in the right ear; the left showed slight impairment for the lower tones. In the left side of the neck was a palpable mass, about 1 cm. in diameter, which was freely movable, not attached to the skin and moderately tender to palpation. There was no redness or swelling about it. The region of the neck along the upper half of the anterior border of the sternocleidomastoid muscle showed four scars of former "discharges."

Treatment.—On April 27, 1938, a culture of material from each nasal fossa was made after removal of crusts and irrigation with sterile saline solution. After induction of local cocaine-epinephrine anesthesia, an opening was made in the right nasal fossa, and the left side was enlarged. The excised tissue was saved for biopsy. The patient was given a bland oil to be sprayed into the nose at home. Bleeding was slight and easily controlled, and packing was not necessary.

Biopsy.—Sections of the excised tissue were prepared and photomicrographs made by Dr. Angelo Gnassi, of the Medical Center, Jersey City, N. J. He gave the following report: "The microscopic observations on tissue from the nose and from the throat are similar, and the specimens are described as one. Sections show atrophic, partially eroded, squamous covering epithelium limited by definite membrana propria. The underlying stroma is diffusely permeated by lymphocytes, plasma cells and monocytes. Scattered throughout but more conspicuous within the derma are large pleomorphic cells, which have reticulated, foamy cytoplasm and eccentrically or centrally placed nuclei. The stroma is inconspicuous. There is moderate vascularization. The pathologic diagnosis is rhinoscleroma."

The result of cultures of material from the fossae was a pure strain of the bacillus of rhinoscleroma. A vaccine was prepared, containing seven hundred to eight hundred million bacteria per cubic centimeter, which was to be used in treatment.

On May 4 the gland in the left side of the neck, the swelling having completely subsided, was excised, with the patient under local procaine hydrochloride anesthesia, and taken to Dr. Gnassi, who made the following report: "Section of the lymph node shows atrophic lymphoid follicles with conspicuous areas of hyalinization. The sinuses are obliterated by reticuloendothelial hyperplasia. The capsule is thickened and fibrosed and dips down to form stout trabeculae. There is moderate hyalinization of arterioles." The sections showed a subsiding nonspecific inflammatory process, with no evidence of involvement by the scleromatous process in the throat (fig. 2).

Injections of the autogenous vaccine were started on May 7, beginning with an intradermal injection of 1 minim (0.06 cc.) in the left forearm. There was immediate redness at the site of injection and a wheal, 2 by 5 cm., was formed in twenty minutes. This remained until the next day, when the patient was seen at the same hour, gradually subsiding after that. She was given 2 minims (0.12 cm.) subcutaneously in the same arm three days after the intradermal injection, with no reaction. The dose was increased at weekly intervals until July 19, when an injection of 0.8 cc. was followed by moderate pain at the site of the injection and some tenderness in the axilla. The same dose given on the following visit produced no symptoms. Her other treatment consisted of instillations of a nasal oily spray containing iodine, menthol and camphor and general hygienic precautions. Roentgen treatment was left for a later time to permit observation of the results of vaccine therapy. The nasal fossae have remained open until the present time, and apparently there is no encroachment as yet on the openings made. The discharge has almost ceased; the odor has disappeared; the patient's speech has lost the nasal twang, and symptomatically she feels much improved. According to her statement, she will be content if the condition can be made to stay as it is now.

SUMMARY

Rhinoscleroma (properly, scleroma) is probably more frequent in the United States than reports indicate. It seems to be well scattered about the country.

If scleroma is borne in mind, the diagnosis of the condition is not difficult.

Though treatment with roentgen rays and radium will not cure, such treatment will arrest and control the progress of the disease.

A report of a case of scleroma is presented.

SUPERNUMERARY EXTERNAL EARS

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NEW YORK
AND
JOSEPH H. SHEPARD, M.D.
COLUMBUS, OHIO

Supernumerary or rudimentary auricles, described in the Japanese literature as naevus cartilagineus,[1] constitute a rare congenital anomaly. They are small teatlike projections on or near the external surface of the tragus. They have been mistaken for fibromas.[2] Because of this confusion and the paucity of reports in the American literature this subject is again brought to the attention of physicians. Of 50,000 children examined by Warner,[3] only 33 had this anomaly, but it is our impression from observations made in the large dermatologic clinic at Bellevue Hospital that the condition occurs more frequently than the figures indicate.

The external ear, which is composed of the auricle and the external acoustic meatus, is formed in the embryo by gradual differentiation and development of six tubercles, which appear on the first and second pharyngeal arches around the lateral, or outer part, of the first pharyngeal cleft. The tubercles form the auricle, or pinna, and the cleft forms the meatus.[4] Supernumerary auricles are thought to develop in the same way, either from the same arches or from those more caudad in the embryo,[5] and to represent an excessive epithelial growth. They are therefore seen either in contiguity with the tragus or just in front of it, on the cheek, or more rarely along the course of the sternocleidomastoid muscle or on the shoulder.

A supernumerary auricle does not as a rule resemble a true external ear in shape or size, being rarely well formed. When single it appears as a smooth half pea-sized, skin-colored elevation, arising abruptly from

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From the Service of Dermatology and Syphilology, Bellevue Hospital, Service of Dr. Howard Fox and Dr. Edward R. Maloney.

1. Aoki: Iconograph. dermat., syph. et urol. **41**:256, 1937.

2. Hays, H. M.: Ann. Otol., Rhin & Laryng. **20**:633, 1911.

3. Warner, cited by Hays.[2]

4. Fraser, J. S.: Maldevelopments of the Auricle, the External Acoustic Meatus and the Middle Ear: Microtia and Congenital Meatal Atresia, Arch. Otolaryng. **13**:1 (Jan.) 1931.

5. Pasupate, B., and Nookhali, I.: Indian M. Gaz. **57**:139, 1922.

the external surface of the tragus. This is the type most commonly observed. The anomaly is usually solitary and unilateral but may be multiple (as many as six or eight) and, rarely, bilateral.[6] The extra auricle is painless and not tender. When it is large a hard cartilaginous core can be felt, which is the main point of differentiation from the ordinary cutaneous fibroma. The smaller auricles differ from moles in size, shape and absence of hair or pigment.

When the anomaly is multiple, it appears as half-pea-sized to bean-sized elevations, situated on the tragus or in the preauricular region along a line drawn from the tragus to the angle of the mouth. These elevations are discrete and usually increase in size from the tragus outward. The larger rudimentary auricles are bulbous and pedunculated; the smaller ones are sessile. The tragus of the affected side may itself be larger than its fellow.

From a study of the literature there is a strong suggestion that the condition is inherited. It occurs more frequently in males than in females.[7]

REPORT OF CASES

CASE 1.—B. L., a man aged 84, had a pea-sized semisolid elevation arising abruptly from the center of the external surface of the right tragus. It had been present since birth without change. The color was that of normal skin. No pigment or terminal hairs were present.

CASE 2.—W. M., a boy aged 5 months, had six rudimentary auricles on the left tragus and the left preauricular region, along a line running from the tragus to the angle of the mouth. Those on the cheek were separated by ½ to ¾ inch (1.27 to 1.91 cm.). Their size varied from that of a split pea to that of a large bean. The hard cartilaginous core could be easily palpated, especially in the larger elevations, on the cheek. The auricles were subsequently excised, and the electric cautery was applied to the stumps. Healing occurred with negligible deformity. The patient's half brother, aged 9 years, had a single extra auricle on the right tragus, which had been present since birth.

CASE 3.—V. L., a girl aged 7 years, had six accessory auricles on the left tragus and the left preauricular region. They varied in size from that of an ordinary match head to that of a pea. Those on the cheek, midway between the lobe of the ear and the angle of the mouth, were conical, hard and the color of normal skin.

CASE 4.—H. H., a man aged 58, presented two auricular appendages attached to the external surface of the right tragus. The larger one was club shaped, constricted at its base and covered by normal skin. The other was pea sized and elevated and had a broad base. A hard core could be palpated in the larger one. The patient's brother had a single supernumerary auricle on the left tragus. The lesions were subsequently excised.

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6. Wendell, C. P.: Diseases of the Ear, Nose and Throat, ed. 7, Philadelphia, F. A. Davis Company, 1928.

7. Williams, E. W.: Bristol Med.-Chir. J. **48**:273, 1931.

Fig.1 (case 2).—Supernumerary auricles in a boy aged 5 months.

Fig. 2 (case 3).—Supernumerary auricles in a girl aged 7 years.

Fig. 3 (case 4).—Supernumerary auricles in a man aged 58.

SUMMARY

Supernumerary auricles, which constitute a rare congenital anomaly, are described. Because of their rarity and the scant literature on the subject, they are often incorrectly diagnosed as fibroma. A differentiation is made.

Brief reports of 4 cases are included.

140 East Fifty-Fourth Street, New York.

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MODIFIED TECHNIC OF IVORY IMPLANTATION FOR OZENA

REPORT OF SIX CASES

JOSEPH P. KASNETZ, M.D.
BROOKLYN

Ozena is a term used to designate any chronic fetid nasal discharge. Two types are mentioned, the primary (or true) and the secondary. The cause of the true type is unknown. The secondary type is the result of tuberculosis, syphilis, chronic sinusitis or nonspecific rhinitis. Intranasal operations have been known at times to produce the condition. This paper deals only with the true type. A method of treatment through employment of an ivory implant is described.

An attempt was made to determine a cause.[1] In all cases the familial background was noncontributory. Likewise the history of past and present illness was found irrelevant. The nutritional status of the patients was normal, and none showed any clinical evidence of endocrine disturbance. The basal metabolic rates varied from — 15 to + 12 per cent. Serologic tests for syphilis were negative; the blood counts and results of examinations of the urine were within the normal range. The ages of the patients varied from 18 to 53. No tangible evidence of occupational influence was found.

It is generally conceded that the middle meatuses of the nasal chambers are most subject to irritation. As a result of this irritation the turbinates, particularly the middle ones, become thin and fragile, and the lining mucous membrane becomes similarly affected.

Histologically the picture of ozena is that of gradual atrophy or wasting away of the different layers of the mucous membrane and the conversion of the different elements into fibrous connective tissue. The ciliated, pseudocolumnar epithelium is either completely destroyed or irregularly replaced by stratified squamous cells. The cells are cloudy and show ill defined nuclei. The glands are degenerated and show wide lumens as the result of the contraction of the proliferative interstitial connective fibers. The walls of the vessels show round cell infiltration,

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From the Rhinological Department, Greenpoint Hospital, Dr. Welt's Service.

1. Rowe, A. W., and Hoople, G. D.: Atrophic Rhinitis: Findings in a Series of Eighty Cases, Ann. Otol., Rhin. & Laryng. **36**:144 (March) 1927.

with marked thickening (described in detail by Dr. Simon Ruskin [2] and Dr. H. L. Pollock [3]).

The common complaints are fetor, nasal obstruction, crusting, mouth breathing, dryness of the throat and occasional headache. Anosmia is infrequent. Only 4 patients of this series presented the facies described as typical of the condition, namely, the deep-seated nasal root, the flat dorsum, the widening of the nostrils and the tilting of the nose upward. Rhinoscopically the most characteristic findings are crust formation and enlarged nasal cavities. The nasal chambers are asymmetric, one always being larger than the other with the greatest width in the middle meatus. The crusts vary from brownish gray or greenish yellow to pronounced black. They may be soft, friable, tough or, sometimes, stony hard. They may appear as uniform laminated structures, adherent to the mucous membrane. They may remain in situ for weeks and are

Fig. 1.—Ivory block 3.5 cm. long, 1.5 cm. wide and 4 mm. in thickness.

sometimes separated from the mucous membrane with difficulty, being removed only as casts from the region which they occupy. They occur in all parts of the nose and frequently extend to the nasopharynx and pharynx. The mucous membrane after the removal of the crusts is thin, pale and gray. Sometimes there is bleeding at the site of removal. Ulcerations are rare.

TECHNIC

The length, width and thickness of the ivory implant employed in the cases in this series varied with the patient. The average size was 5 cm. by 1.5 cm. by 5 mm. The corners of the implant were rounded off and the surfaces sandpapered. A number of holes were drilled to diminish the weight (fig. 1). The block was then washed with soap and water, boiled for a half-hour and placed in a physiologic solution of sodium chloride until ready for use.

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2. Ruskin, S. L.: Differential Diagnosis and Therapy of Atrophic Rhinitis and Ozena, Arch. Otolaryng. **15**:222 (Feb.) 1932.

3. Pollock, H. L.: Genuine Ozena in the Light of Recent Investigations, Tr. Am. Laryng., Rhin. & Otol. Soc. **40**:344, 1934.

The patient's nose was irrigated with sterile water until all crusts were removed. For patients whose nasal membrane was found to be too thin to work with, I found it practical to pack both nasal chambers with iodoform gauze for twenty-four hours, which caused the septal membrane to become hyperemic and thickened. With the patient in a sitting posture, the nose and upper lip were washed with soap, water and alcohol, and mercurochrome was applied. A 5 per cent cocaine pack was placed in each chamber for five to ten minutes. In addition it was found advisable to inject a 2 per cent solution of procaine hydrochloride

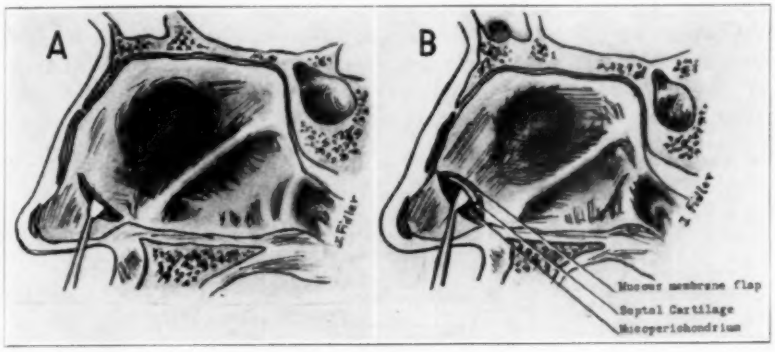

Fig. 2.—*A*, incision through the mucous membrane, the mucoperichondrium being left intact. *B*, incision through the mucoperichondrium and the quadrangular cartilage.

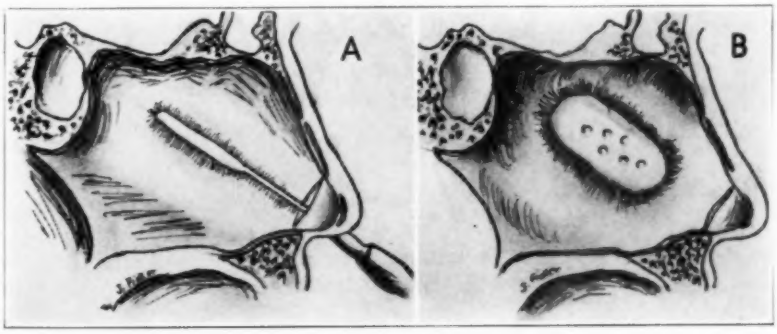

Fig. 3.—*A*, pocket block for the ivory on the opposite side of the septum between the mucoperichondrium and the septal cartilage. *B*, ivory block in its permanent place.

at the mucocutaneous junction, as in this region the cocaine is not absorbed sufficiently to produce complete anesthesia.

In order to prevent secondary infection along the surgical route, the incision was made on the opposite side of the septum from where the block was to be embedded. With a Freer knife the incision was made in the mucous membrane down to the perichondrium but ***not through it*** (fig. 2*A*). The purpose of this procedure was to permit sufficient allowance for shrinkage of the flap. Then the mucous membrane was elevated for about 5 mm. and the perichondrium cut

through (fig. 2 *B*), with exposure of the quadrangular cartilage. At this point the cartilage also was cut through, as for a submucous resection. A sharp elevator was inserted between the cartilage and the mucoperichondrium on the opposite side, and, with great care not to lacerate the mucous membrane, a pocket large enough to accommodate the ivory block was made in the region of the middle meatus (fig. 3 *A*). The block was now taken from the saline solution and introduced into the new mucoperichondral cartilaginous space (fig. 3 *B*). The flap was then approximated and loose packing applied for twenty-four hours. Sutures were not employed, because sufficient allowance for shrinkage of the flap was made; thus, none of the quadrangular cartilage was exposed. In the process of healing it takes weeks for for stripped cartilage to be covered with regenerated mucous membrane as compared with only a few days for mucoperichondrium.

The ivory should fit loosely. When the tension on the mucous membrane was too great, a liberating incision was made through the septal cartilage (fig. 4). The patient was usually kept in the hospital for twenty-four hours.

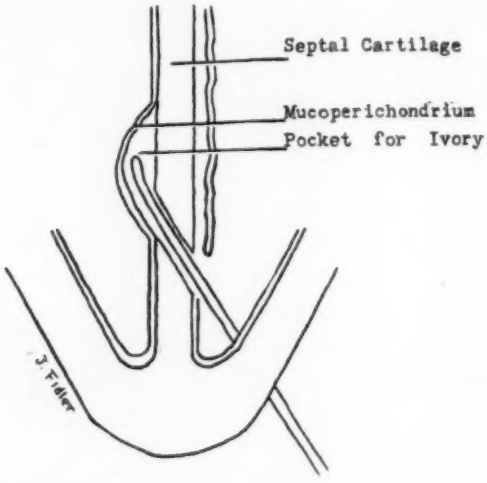

Fig. 4.—Vertical cross section of the septum, showing the liberating incision through the quadrangular cartilage.

RESULTS AND CONTRAINDICATIONS

The reaction was slight, with a rise of temperature to 100.5 F. for twenty-four to forty-eight hours. Occasional headache and local pain from pressure were experienced. All the patients were completely relieved of the most dreaded complaint, namely, the fetid odor. The mucous membrane became free from crusts, moist and pink. Patients who suffered from concomitant atrophic pharyngitis were completely relieved of their pharyngeal dryness. The patients' general attitude was changed. They appeared brighter, more cheerful and more social minded.

The earliest implantation was performed five years ago and the latest the first week in September 1938. All patients are instructed to appear for rhinoscopic examination semiannually.

Contraindications for the use of the ivory implant are: (1) a perforated septum, (2) too thin a septum, (3) too roomy a chamber, in which the size and weight of the block would be too severe a strain for the mucous membrane, (4) an organic or constitutional ailment of the patient and (5) suppurative sinusitis or suppurative pansinusitis.

COMMENT

A variation in the treatment of ozena is described.[4]

Patients obtain instant relief without being subjected to extensive surgical intervention.

The results are permanent, and no further treatments are necessary so long as the ivory implant remains in the septum.

The relief of the symptom complex of ozena through this ivory implant is difficult to explain. The probability is, however, that the desired results are obtained by the narrowing of the chambers through the mechanical introduction of the block.

Failure may result from (1) the use of too large a block, (2) the use of the proper size block but too small a pocket, (3) laceration of the mucous membrane in the process of operation, so that the ivory sloughs through the opening, or (4) operation on the side of the septum on which the block is to be embedded, with a resultant infection extending from this site to the newly formed pocket.

Of the 6 operations performed, only 1, the first, was unsuccessful. The ivory sloughed out eight weeks after the operation, and all the symptoms recurred. The reasons for my failure are enumerated in the preceding paragraph, either (1) or (2) and (4). The other 5 patients are still retaining the implant. They are all symptom free and enjoy good health.

678 Eastern Parkway.

4. Stovin, J. S.: Use of Galvanic Current in the Treatment of Atrophic Rhinitis and Ozena, Arch. Otolaryng. **25**:305 (March) 1937. Morwitz, S. M.: The Surgical Management of Ozena, Illinois M. J. **69**:130 (Feb.) 1936. Wachsberger, A.: A New Technique in the Surgical Treatment of Ozena, Arch. Otolaryng. **19**:370 (March) 1934; The Surgical Treatment of Ozena, Tr. Am. Acad. Ophth. **38**:387, 1933. Bernstein, J.: A Note on the Treatment of Atrophic Rhinitis, J. Laryng. & Otol. **48**:603 (Sept.) 1933. Kemler, J. I.: Implantation of Ivory in Ozena: Approved Technic; Further Observations, Arch. Otolaryng. **13**:726 (May) 1931.

A CONTROLLED STUDY OF "COLD VACCINES"

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AND
MAURICE J. HAUSER, M.D.
DETROIT

There has been continued controversy among members of the medical profession as to the effectiveness of "cold vaccines" in immunizing against the common cold or even in abating its severity and preventing serious complications. Whereas a general survey of the literature points to rather encouraging results, there are outstanding, progressive physicians who feel that nothing is accomplished by such vaccines.

In the year 1935-1936 there were some 10,000 students enrolled in the University of Michigan. At the student health service during this period, approximately 4,000 of these students were treated for infections of the upper part of the respiratory tract on more than six thousand separate occasions. In the same year almost 600 students were confined to the health service for treatment of the common cold or its complications for a total of nearly four thousand days, the average period of confinement per patient being six and two-tenths days. The number of additional days spent at home in the treatment of infections of the respiratory tract is incalculable.

During the past years numerous students had sought our advice about "cold vaccines." They were never encouraged to take such vaccines, but if a student was anxious to try a vaccine a stock or an autogenous preparation was given in the generally accepted fashion. No attempt was made to determine definitely whether or not the student considered that this preventive measure had been of any benefit.

Because the literature was merely suggestive of beneficial results and because we ourselves felt from superficial observations and from the teachings handed down to us that "cold vaccines" were of little value, we decided to undertake a controlled experiment. Our objective was a definite experience of our own tending to determine the value of such vaccines.

Although it would have been highly desirable to try various stock vaccines and autogenous vaccines on different groups of persons, it seemed perhaps better, in view of the limited number of subjects coming to us, to concentrate on one stock preparation and to administer it to

From the University of Michigan Medical School.

as large a group as possible. From the observations, it was hoped, an opinion could be formulated which would hold for at least that one vaccine and possibly for others of the same type. For this study a vaccine was selected [1] containing: Friedländer's bacillus, 100,000,000 per cubic centimeter; Bacillus influenzae, 200,000,000; Pneumococcus, 100,000,000; Streptococcus, 100,000,000; Micrococcus catarrhalis, 200,000,000, and Staphylococcus, 400,000,000.

We decided to give the vaccine subcutaneously to one group, administering 0.25 cc. the first week, 0.5 cc. the second week, 0.75 cc. the third week and 1 cc. the fourth week. To the members of the same group, when practical, 1 cc. would be given additionally one month later. Because it is difficult to hold the interest of several hundred persons in an experiment of this type, we decided against advising that the injection of vaccine be continued through the winter at monthly intervals, although we believed that that would be the ideal and logical plan of administration.

To subjects of the second group we determined to give the vaccine intradermally, giving the same number of injections as to those of the first group. We planned to give 0.05 cc. the first week, 0.1 cc. the second week, 0.2 cc. the third week and again 0.2 cc. the fourth week. To the members of this group who would return to us one month later, we would administer 0.2 cc.

The third group was designated as the control group. To the subjects assigned to it hypodermic injections of sterile water would be given, 0.5 cc. each time. The injections were to be given at weekly intervals, with a fifth injection after one month if the subject returned to us. Because we ourselves felt that we were accomplishing little or nothing by giving the vaccine, it was not particularly disturbing to substitute hypodermic injections of sterile water for injections of vaccine in a limited number of instances.

We let it be known that we were prepared to administer a "cold vaccine" to those students who desired to take it. No selection of types was employed. Although we superficially examined the ears, nose and throat of each person who came to us, noting the presence or absence of tonsils and the general condition of the nose, we did not refuse the vaccine to any one. Each person was asked how many colds he had had during the preceding year and whether he would classify his colds as mild, medium or severe. A record was kept of the impressions of previous colds. To the first 10 persons we gave the vaccine subcutaneously, and to the next 10, intradermally; to the following 10 we gave placebos. This cycle was repeated until there were 100 persons in each group. After this number was reached the vaccine was given sub-

1. Sherman's 39, G. H. Sherman, M.D., Inc.

cutaneously to all those who presented themselves at the clinic for treatment. We continued to treat each person as he returned at weekly intervals by the same method and with the same type of solution. A total of 200 students received the vaccine subcutaneously; 100 received it intradermally, and 100 were given placebos. There was no reaction other than the local inflammation immediately about the site of injection.

TABLE 1.—*Data on Patients Who Received Vaccine Subcutaneously*

Classification of Colds in Preceding Year	Subjects	Comparison of Current and Preceding Year as to Number of Colds: Subjects Reporting				Subjects Reporting Colds Aborted	Subjects Reporting Colds Not Aborted	Subjects Desiring Vaccine Treatment Next Year	Subjects Not Desiring such Treatment Next Year
		Same	Fewer	None	More				
Mild.....	16	5 (31%)	8 (50%)	2 (13%)	1 (6%)	11 (69%)	5 (31%)	13 (81%)	3 (19%)
Medium.....	116	21 (18%)	86 (74%)	7 (6%)	2 (2%)	91 (78%)	25 (22%)	110 (95%)	6 (5%)
Severe.....	56	7 (12.5%)	46 (82%)	2 (3.5%)	1 (2%)	46 (82%)	10 (18%)	52 (93%)	4 (7%)
Total.....	188	33 (18%)	140 (74%)	11 (6%)	4 (2%)	148 (79%)	40 (21%)	175 (93%)	13 (7%)

TABLE 2.—*Data on Patients Who Received Vaccine Intradermally*

Classification of Colds in Preceding Year	Subjects	Comparison of Current and Preceding Year as to Number of Colds: Subjects Reporting				Subjects Reporting Colds Aborted	Subjects Reporting Colds Not Aborted	Subjects Desiring Vaccine Treatment Next Year	Subjects Not Desiring such Treatment Next Year
		Same	Fewer	None	More				
Mild.....	11	6 (55%)	2 (18%)	3 (27%)	0	5 (45%)	6 (55%)	10 (91%)	1 (9%)
Medium.....	71	20 (28.1%)	42 (59.1%)	6 (8.4%)	3 (4.2%)	45 (63%)	26 (37%)	66 (93%)	5 (7%)
Severe.....	13	5 (38.5%)	6 (46%)	2 (15.5%)	0	8 (62%)	5 (38%)	12 (92%)	1 (8%)
Total.....	95	31 (32.6%)	50 (52.6%)	11 (11.6%)	3 (3.2%)	58 (61%)	37 (39%)	88 (93%)	7 (7%)

The first injections were given during the third week in October and the last ones by the middle of December. During the last two weeks in May we interviewed each student who had received the injections, provided that he had completed the series. We were able to obtain data from 188 persons who had received the vaccine subcutaneously, 95 who had received it intradermally and 86 to whom placebos had been given. The cases were grouped according to the number of colds in previous years and according to the classification of these colds as mild, medium or severe. Each person was asked whether the number of colds during the year of the experiment had been the same as, greater than

or less than that during the past year, whether or not he had colds which quickly became aborted and whether he would again take the vaccine.

Of the persons who had received the vaccine subcutaneously, 74 per cent said that they had had fewer colds, 6 per cent no colds at all, 18 per cent the same number as during the preceding year and 2 per cent more colds. Of those who had received the vaccine intradermally, 52.6 per cent reported that they had had fewer colds, 11.6 per cent no colds at all, 32.6 per cent the same number as before and 3.2 per cent more colds. Among those who had received placebos, 60.5 per cent

TABLE 3.—*Data on Patients Who Received Placebos*

Classification of Colds in Preceding Year	Subjects	Comparison of Current and Preceding Year as to Number of Colds: Subjects Reporting				Subjects Reporting Colds Aborted	Subjects Reporting Colds Not Aborted	Subjects Desiring Vaccine Treatment Next Year	Subjects Not Desiring such Treatment Next Year
		Same	Fewer	None	More				
Mild.....	8	3 (37.5%)	3 (37.5%)	1 (12.5%)	1 (12.5%)	4 (50%)	4 (50%)	7 (87.5%)	1 (12.5%)
Medium.....	55	21 (38%)	30 (55%)	3 (3%)	1 (2%)	33 (60%)	22 (40%)	50 (91%)	5 (9%)
Severe.....	23	3 (13%)	19 (83%)	1 (4%)	0	18 (78%)	5 (22%)	22 (96%)	1 (4%)
Total.....	86	27 (31.4%)	52 (60.5%)	5 (5.8%)	2 (2.3%)	55 (64%)	31 (36%)	79 (92%)	7 (8%)

TABLE 4.—*Summary of Data*

Method	Comparison of Current and Preceding Year as to Number of Colds: Subjects Reporting				Subjects Reporting Colds Aborted	Subjects Reporting Colds Not Aborted	Subjects Desiring Vaccine Treatment Next Year	Subjects Not Desiring such Treatment Next Year
	Same	Fewer	None	More				
Vaccine subcutaneously	18%	74%	6%	2%	79%	21%	93%	7%
Vaccine intradermally	32.6%	52.6%	11.6%	3.2%	61%	39%	93%	7%
Placebo.....	31.4%	60.5%	5.8%	2.3%	64%	36%	92%	8%

reported that they had had fewer colds, 5.8 per cent no colds at all, 31.4 per cent the same number as the last year and 2.3 per cent more colds.

In the first group, to which the vaccine was given subcutaneously, 79 per cent felt that they had had one or more colds which rapidly became aborted. This was true also of 61 per cent of those who had received the vaccine intradermally and 64 per cent of those who had received placebos. Almost all the subjects appeared enthusiastic about taking a vaccine again; 93 per cent of the first two groups, which had been given vaccine, expressed a desire to be immunized the following year, and 92 per cent of the control group expressed the same desire.

From further analysis of the data we found that the greatest improvement was accomplished by subcutaneous administration of the vaccine to persons whose colds were described as "medium" and "severe," the percentage of persons reporting improvement reaching 80 in the former and 85.5 in the latter group. Of corresponding persons treated by the intradermal method, 57.5 per cent and 61.5 per cent, respectively, reported that they were benefited. Correspondingly, among those to whom placebos were given, 60 per cent and 87 per cent, respectively, reported similar results.

We were impressed by the inability of the average person to be certain of the exact number of colds from which he had suffered both during the preceding year and during the period of the experiment. Because of this, our data represent impressions rather than absolute facts.

There were no serious complications of colds in any of the 369 persons included in the study. It is our impression, however, that the group is too small to justify any conclusions in reference to complications.

SUMMARY

Over 66 per cent of subjects who received placebos stated that they had had fewer colds than during the year preceding the experiment.

Of the persons who were given the vaccine intradermally, over 64 per cent considered themselves similarly improved. Of those who were given the vaccine subcutaneously, 80 per cent reported that they had had fewer colds than during the preceding year.

Though the proportion of subjects reporting improvement was greatest in the group in which the vaccine was given subcutaneously, the percentage of difference between the three groups is within the limits of possible error.

Over 90 per cent of the subjects in all groups expressed a desire to be similarly treated the following year.

Case Reports

HEMANGIOMA OF SKULL INVOLVING RIGHT PETROUS AND OCCIPITAL BONES

EDWIN R. IRGENS, M.D., WATERVILLE, MAINE

Hemangioma involving bones of the skull, so far as I have been able to ascertain, is rare. Bucy and Capp,[1] in 1930, reviewed the literature and found 12 cases, including 1 which they reported. Geschickter [2] added to the number by reporting 5 cases taken from a group of more than 1,700 neoplasms of bone. Anspach,[3] in February 1937, in reporting a case of hemangioma of the left parietal bone, stated that he had found only 21 cases of hemangioma of the skull reported in the literature.

The majority of the hemangiomas of the skull reported involved the parietal bones, and next in frequency was the frontal bone. Bucy and Capp referred to a case of hemangioma of the left petrous bone reported by Brandt in 1921.

REPORT OF A CASE

Mrs. H., aged 28, was seen in association with Dr. F. T. Hill at the Thayer Hospital on Nov. 24, 1936.

History.—Paralysis of the right side of the face had developed three years before, following the birth of a child. There had also been gradual impairment of hearing in the right ear. The patient had been seen in consultation two years before by Dr. F. T. Hill, who found at that time complete paralysis of the right side of the face, a small, soft, easily bleeding mass in the floor of the bony canal and a normal membrana tympani. Roentgen examination at that time showed normal pneumatic mastoids—no evidence of erosion or absorption. Further study had been requested of the referring physician, but the patient had not been seen again until November 1936.

During the past year it was thought that there had been slight improvement in the paralysis; that is, the eye could be closed slightly, and there had been less difficulty in eating because of biting the lips. A discharge from the right ear had been noted for two months. There had been occasional pain for about two weeks.

Examination.—Paralysis of the right side of the face was present. There was no exophthalmos. Movements of the eyes were normal. The fields and fundi were normal. The tongue protruded in the midline. Sensation to touch and pain over the face was intact. The left ear was normal. Examination of the right ear showed a slight foul discharge and a slightly irregular, gray-pink, rather firm

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Read before the New England Otological and Laryngological Society, Boston, Nov. 17, 1937.

1. Bucy, P. C., and Capp, C. S.: Primary Hemangioma of Bone with Special Reference to Roentgenologic Diagnosis, Am. J. Roentgenol. **23**:1 (Jan.) 1930.

2. Geschickter, C. F.: Primary Tumors of the Cranial Bones. Am. J. Cancer **26**:155 (Jan.) 1936.

3. Anspach, W. E.: Sunray Hemangioma of Bone with Special Reference to Roentgen Signs, J. A. M. A. **108**:617 (Feb. 20) 1937.

Fig. 1.—Axiopulpal view, showing a large area of rarefaction involving the occipital and the lower portion of the petrous bone.

Fig. 2.—Lateral view of the mastoids; the arrow indicates the area of rarefaction in the right mastoid; the normal left mastoid is shown for comparison.

mass, blocking the canal and within 0.5 cm. from the concha. The results of the hearing test were as follows: In the right ear, a whisper could not be heard; conversation could be heard at 2 feet (61 cm.); the Rinne test gave a score of 0/8. In the Weber test the sound was heard best in the right ear. In the left ear, a whisper could be heard at 20 feet (610 cm.) and conversation at 35 feet (1,067 cm.); the score for the Rinne test was 24/8. Roentgen examination showed increased density of the right mastoid and destruction of the lower part of the

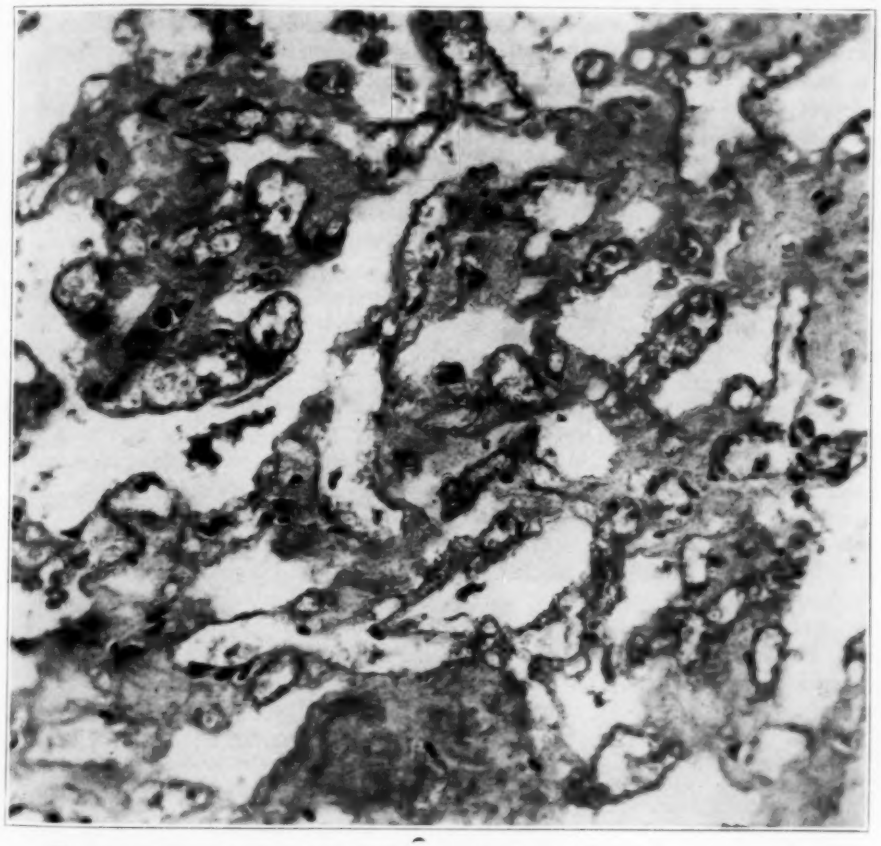


Fig. 3.—Hemangioma. Section from a biopsy specimen taken from a tumor presenting in the right external auditory meatus (× 300).

petrous bone and adjacent occipital bone, posteriorly. Apart from the findings given, physical examination revealed no abnormalities.

Course.—It was felt that the rarefaction was due to the presence of a tumor, probably hemangioma, of which the mass in the aural canal was a part. Taking of a biopsy specimen was followed by a hemorrhage, which was controlled with difficulty. The specimen was reported by Dr. Tracy Mallory as being a hemangioma.

Because of the fairly rapid growth of the tumor, it seemed that treatment should be directed, first, toward diminution of the blood supply to the area and, second, toward bringing about fibrosis and ossification in the tumor by radiation.

On December 1 the patient was admitted to the hospital, and on the following day the right common carotid artery was ligated. The external carotid artery also was ligated to prevent a flow of blood to the internal carotid artery—carrying blood received through the anastomosis between the two external carotid arteries. Recovery was uneventful, and the patient was discharged ten days later.

On the second admission, Jan. 4, 1937, a partial radical mastoidectomy was done; that is, the operation was not completed because of rather severe bleeding. The lining of skin and soft tissue in the external acoustic meatus was found eroded and incomplete along the floor. At a point which seemed just external to the drum membrane, there was a dehiscence in the floor of the canal, into which a probe could be introduced about 4 mm. This fact was determined after removal of the tumor blocking the canal. The postaural wound was partially closed and packed with iodoform gauze. On January 19, 50 mg. of radium was introduced into the mastoid cavity, with a portal on the dehiscence in the floor of the canal, and left in place twenty hours, the dose thus being 1,000 milligram hours. Two days later the patient was discharged convalescent.

On January 30, the date of the patient's third admission to the hospital, a Siebenmann flap was cut and the postaural fistula closed. Two weeks later she was discharged from the hospital, with the postaural wound closed and dry. Afterward, she was seen at intervals of from a few weeks to a month, but soon after she left the hospital a postaural fistula developed. During the next six months this increased slightly in size, and inferior to it a small, dry area of bare, dead, sclerotic bone appeared.

On September 1 she was again admitted to the hospital, for plastic closure of the fistula and removal of the necrotic bone. Moderate secondary infection developed in the postaural wound, and several sutures gave way. The pulse rate and temperature were elevated for several days, gradually subsided and on the sixth day were normal. At this time there was some complaint of rather severe headache, which recurred several times during the next five days. On the twelfth day the patient was discharged, principally because she wished to return home—a distance of 30 miles (48 kilometers). She was advised to return in two days for dressing. On September 16, a letter was received stating that the patient had died at her home at 10 that morning. Headache had been complained of intermittently. The temperature ranged around 100 F. for the last two days; the pulse rate was said to be strong and regular up to the time of death. For a period of twelve hours after subsidence of the headache she was semiconscious. Then followed a short period of delirium, after which she lapsed into unconsciousness, and she died six hours later. Permission for postmortem examination could not be obtained.

COMMENT

Radium was used in the treatment of a hemangioma of the skull. The danger of necrosis and infection of bone must be borne in mind but in this case was slight.

I believe that in this particular case, as in 2 cases reported by Dandy, referred to by Geschickter, the hemangioma involved not only the skull but also the dura and brain—judging from the manner in which death occurred.

DOUBLE VOCAL CORD

DAVID I. FRANK, M.D., AND MILTON MALEV, M.D., NEW YORK

Congenital reduplication of one or both vocal cords appears to be an extremely rare anomaly. We have been able to find reports of only 5 cases, all in the foreign literature. We report here a case, with autopsy, of unilateral occurrence of this anomaly, in a patient who died of pulmonary tuberculosis.

REPORT OF A CASE

Mrs. N. F., a Negress aged 49, was admitted to Riverside Hospital on July 30, 1937. Examination revealed extensive bilateral tuberculosis, with submiliary involvement on the right side and extensive pyopneumothorax on the left. She stated that she had been hoarse all her life; otherwise there was nothing pertinent in her history. Examination of her sputum gave positive results, and her Kahn test was negative. A routine examination of the larynx was attempted during her confinement in the hospital, but she was uncooperative, making it impossible to visualize her larynx. In view of her toxic condition, no further attempt was made to examine her. Her course was steadily downhill, and she died on November 22. An antemortem description of her larynx was thus not obtainable.

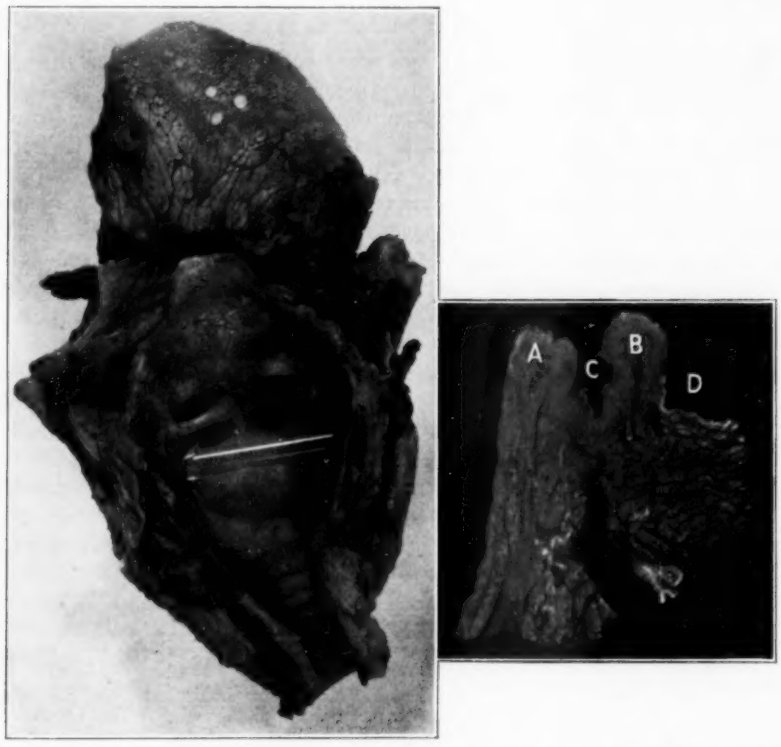
The anatomic diagnosis at autopsy by one of us (M. M.) was extensive bilateral tuberculosis, with cavitation and left pyopneumothorax, tuberculous enterocolitis and generalized amyloidosis. The larynx showed no edema, swelling or ulceration. The right ventricular band and vocal cord were normal. The left ventricular band was normal. The left vocal cord was somewhat thinner than the right and was reduplicated somewhat beneath itself by another similar cord running parallel to the first, merged with it at its extreme ends and separated from it over the entire length by a narrow but rather deep cleft. Microscopic section through the double cord showed two protruding masses of muscular tissue in typical arrangement, covered by stratified squamous epithelium. The epithelium was absent in the cleft. In numerous places under the intact epithelium, there were epithelioid cell tubercles and several giant cells. The same section stained with the elastica–Van Gieson stain showed the fibrous layer in the submucosa dipping with the cleft to follow the entire free margin of the double cord, as shown in the illustration.

A case of doubling of the vocal cords was reported by Dr. Alezais [1] in 1912. His patient, likewise, had pulmonary tuberculosis, and only one of the cords was doubled. He had also reported a case in 1906 in which both cords were doubled. These 2 cases were observed in the course of 800 autopsies.

From the Tuberculosis Service and Pathological Department of the Riverside Hospital.

1. Alezais: Dédoublement de la corde vocale inférieure droite, Larynx, l'oreille et le nez **5**:106 (July) 1912.

Lautenschlager [2] reported a case in 1912 of doubling of both vocal cords. His patient presented himself to the clinic for a submucous resection, and a routine examination of the larynx revealed this anomalous condition on both sides. A negative Wassermann test and the absence of a history of active tuberculosis or of croup, together with the symmetric, smooth contour of the duplication, had sufficient weight to establish that the condition was congenital and not due to any ulcerative process. It is interesting to note that Lautenschlager suggested as a therapeutic measure that the clefts between the double cords be filled in with paraffin.



Left, photograph of the larynx, showing the double cord on the right side. Right, photomicrograph of a vertical section through the double cord (× 10). *A* and *B* indicate the doubled cord, *C* the cleft between the double cord and *D* the ventricle.

Berger [3] reported a case in 1928. A 23 year old man who had suffered with hoarseness since his youth showed on examination a doubling of both vocal cords. The true vocal cords were red, swollen

2. Lautenschlager, E.: Ein Fall von Doppelbildung der Stimmbänder, Arch. f. Laryng. u. Rhin. **26**:706, 1912.

3. Berger, W.: Beitrag zur Frage der doppelten Stimmlippen, Ztschr. f. Hals-, Nasen- u. Ohrenh. **19**:426 (Feb.) 1928.

and indistinct, and a few millimeters under the true glottis a second glottis was observed. It was formed by two narrow, sharply defined white cords, which ran parallel to the true cords.

Citelli [4] also reported a case of double vocal cords. However, he had been inclined to consider such duplication a sulcus of the glottis —sulcus glottidaeus—rather than two true distinct cords. In a detailed anatomic study he was able to demonstrate that a sulcus appears in about 55 per cent of normal larynxes. The sulcus is usually symmetric and extends through the whole of the cord but is not evident to the naked eye. In some cases the sulcus is accentuated so that the vocal cords appear doubled. He feels that his case, as well as the case reported by Lautenschlager, which he reviews in his article, is an instance of such accentuation of the sulcus. He has pointed out that this sulcus is more frequent in children and young people and is constant in some animals. He declares that it represents a congenital formation that is of morphologic importance and that it has a tendency to disappear in the adult.

The constant factor in all reported cases of double vocal cords, including ours, is lifelong hoarseness of greater or lesser degree. The hoarseness is accounted for by the improper closure of the larynx.

The observation of Citelli with regard to the sulcus glottidaeus is interesting. We have not been able to find any other similar observation in the literature. The classic treatise on "The Mechanism of the Larynx" by Negus fails to mention such a sulcus.

In our case, the incidental finding of microscopic evidence of tuberculosis in an apparently intact larynx suggests that statistics on the frequency [5] of laryngeal tuberculosis would be unreliable if based on gross examination alone.

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4. Citelli, S.: Sullo s'doppiamento congenito delle corde vocale, Boll. d. mal. d. orecchio, d. gola, d. naso **31**:193 (Sept.) 1913.

5. Frank, D. I., and Wolf, G. D.: Present Status of Laryngeal Tuberculosis, New York State J. Med. **37**:1652 (Oct. 1) 1937.

STREPTOCOCCIC MENINGITIS WITH RECOVERY

R. Wallace Teed, M.D., Ann Arbor, Mich.

The advent of sulfanilamide has considerably improved the prognosis for many types of streptococcic infection. With otogenic meningitis due to this organism, for example, the mortality previously approached 100 per cent, whereas in the past year approximately 40 recoveries have been reported, either formally or informally. In the belief that all recoveries following the use of sulfanilamide should be reported, the following record is given.

REPORT OF A CASE

W. J. F., a white boy aged 6 years, was admitted to St. Joseph's Mercy Hospital on Jan. 11, 1938, in a comatose delirium. The parents stated that the boy had contracted an acute cold five weeks previously and the next day complained of pain in the left ear. Three days later discharge from the ear was noted, which had continued uninterruptedly ever since. Further symptoms did not appear until about a week prior to admission, when the patient began to vomit. The attending physician ascribed the attacks to "biliousness" and prescribed an antacid mixture. On the day before admission the child became nervous and irritable, and a diagnosis of hysteria was made. This hyperirritability continued, but several hours before admission the child became unresponsive, and it was felt that some more serious disease was present. The vomiting continued at intervals, although the patient had not complained of any pain in the ear.

The child had been rather subject to infections of the upper part of the respiratory tract, although he had never had an aural disease previously. Sore throats had been infrequent, and quinsy had not occurred. The glands of the neck had been enlarged on numerous occasions but had never suppurated. The patient had had the usual diseases of childhood but not any serious illness or operations.

Examination revealed a well developed but rather poorly nourished white boy, lying on the right side with the head retracted and crying out occasionally with a shrill, piercing cry. He did not respond to questions, and, although the eyes were open, he did not appear to see the examiner. Attempts to move the limbs or to flex the neck resulted in loud cries. The lips were red, dry and covered with crusts. The skin of the face and body was hot and pink. The nares contained crusted pus. The septum was straight. The turbinates were red and congested, and pus was present in both ethmoid regions. The teeth were essentially normal. The tongue, palate and buccal mucosa were dry and covered with crusts. The tonsils were large, septic and subacutely inflamed. There were a few small glands on both sides of the neck. The right external canal was clean and the myringa normal. The left canal was filled with thick, yellow, foul pus. The posterosuperior wall of the canal sagged markedly, so that only a small portion of the myringa was seen. Normal landmarks could not be identified. Swelling over the mastoid was not present, nor did pressure elicit appar-

ent pain. The eyes wandered from side to side, but definite nystagmus could not be made out. The neck was definitely rigid, and there was a positive Kernig sign. The heart and lungs were essentially normal.

Roentgenologic examination of the left mastoid revealed a hazy and cloudy appearance throughout, with destruction of bone in the central portion.

Examination of the blood revealed 26,500 leukocytes, with 10 per cent lymphocytes, 84 per cent polymorphonuclears and 6 per cent monocytes. The reaction to the Kahn test was negative. The urine had a specific gravity of 1.029, showed a faint trace of albumin and gave a 4 plus reaction for sugar. A lumbar puncture released cloudy fluid under increased pressure, with 1,600 cells per cubic millimeter. The reaction to the Pandy test suggested albuminuria (2 plus), and the stained sediment contained millions of streptococci.

A diagnosis of acute suppurative otitis media and mastoiditis (on the left), with streptococcic meningitis, was made, and after the patient had been given 500 cc. of 5 per cent dextrose in saline solution an immediate mastoidectomy was done. On elevating the periosteum over the posterior part of the mastoid, a perforation was noted through the cortex into a fairly large abscess. It appeared strange that clinical evidence of a subperiosteal abscess should not have been seen. The entire cortex was soft, and all the cells were diseased. The entire tegmen was removed and the dura exposed over a wide area. An extradural abscess was not seen. The sinus plate appeared to be healthy and was not removed. The tip was necrotic and was removed in its entirety, the wound then being packed with petrolatum gauze and left wide open. The patient bore the operation well and was returned to bed. During the night he began to show signs of consciousness, and by morning he responded normally and appeared cooperative.

A second lumbar puncture, on January 12, with the patient under anesthesia induced by nitrogen monoxide, revealed clear fluid, still under pressure, and 20 cc. was removed. This was later reported to show but scattered streptococci. The wound was inspected after the puncture, and as the dura was still bulged an incision was made. This was followed by the escape of a large amount of clear fluid. The patient was returned to bed, and further fluids were given intravenously. He was given also sulfanilamide by mouth, 10 grains (0.65 Gm.) every two hours for eight doses and then 10 grains (0.65 Gm.) every six hours for five days. After that, he was given 10 grains (0.65 Gm.) twice a day for eleven days.

On January 13, which was the second day after operation, he was given a direct blood transfusion of 300 cc. He was conscious and cooperative and took fluids well. The temperature was 100 F.

On January 14 the wound was inspected again and found clean. The dura was not bulged, and the patient did not complain of headache. The temperature was 100 F.

On January 16 the erythrocyte count was 4,320,000, with 86 per cent hemoglobin. Another direct transfusion of 300 cc. was given on January 17, at which time the dura was healthy and there was little discharge from the wound. The general condition of the child was satisfactory, and he had a good appetite. There was only a slight amount of moisture in the auditory canal.

The rigidity of the neck gradually disappeared, and the child did not complain. On January 24 the wound was closed except for a rubber tube inserted at the bottom of the incision for drainage. Healing was satisfactory, and the sutures were removed on January 28. The tube was removed on January 31, when the canal was dry. The child was allowed to be up and about on February 3

and was discharged from the hospital on February 5. He was seen in the outpatient department on several occasions, and residuals could not be noted. The ear remained dry and the hearing excellent. The parents were advised to bring the child in for the removal of tonsils and adenoids in about three months.

On May 5, 1938, at 2:10 a. m., the patient was again admitted to the hospital in coma. The parents stated that four days previously he had had his tonsils and adenoids removed in a nearby town and that he was apparently doing well until about four hours prior to admission, when he began to complain of a fulness in the left ear (the site of the previous operation). A short time later, he vomited and in a few moments had a convulsion. The family physician was called, and the convulsion ceased after the administration of a narcotic. The child then lapsed into coma and was brought to the hospital.

Examination revealed the child in partial delirium. He was throwing himself from side to side in the bed but made no response to questions or requests. There was no rigidity of the neck, and the Kernig sign was negative. The pupils were equal and regular and responded to light. The eyes wandered from side to side, but nystagmus was not present. The temperature was 101 F., and the pulse rate 120. The nares were clean, and there was a small amount of mucopurulent material in each ethmoid region. The faucial wounds were covered with healthy granulations and appeared to be healing normally. Glands were not palpable in the neck. The right ear was normal throughout. The left external acoustic canal contained a small amount of serosanguineous material, but a sagging of the posterosuperior wall of the canal could not be made out. The drum was red and bulging, but a perforation could not be seen. The mastoidectomy wound on the left side was entirely healed but was red and slightly swollen. No fluctuation could be made out, and the patient did not respond to pressure over this area. The urine was essentially normal. The leukocyte count was 15,300, with 61 per cent polymorphonuclears, 38 per cent lymphocytes and 1 per cent band cells.

The patient was lightly anesthetized with nitrogen monoxide and oxygen, and a lumbar puncture was done. Clear fluid under increased pressure was obtained. The left myringa was incised, with the release of seropurulent fluid. On his return to bed, the patient was still unconscious, although by 5:30 a. m. he recognized his mother. By 7:00 a. m. he appeared fully conscious and remained so. Sulfanilamide was given intramuscularly, 1 ampule every three hours for three doses. Oral administration was then begun, 10 grains (0.65 Gm.) every three hours for six doses, then 10 grains (0.65 Gm.) every six hours for six doses.

The removed spinal fluid did not contain cells or bacteria, and a culture was also negative. The discharge from the left ear contained a staphylococcus, both on smear and on culture.

On May 6 the child appeared to be quite well. He did not complain of headache, vertigo or pain in the ear. There was slight otorrhea on the left, but the wall of the canal did not sag. Neurologic examination by Dr. Harold Riggs revealed nothing except a slight bilateral weakness of the facial nerve. The temperature and pulse rate were normal, and the boy had a good appetite.

The left ear was dry on May 8, and the patient was allowed to sit up in a chair on May 10. The following day he was allowed to walk around, and on May 14 he was discharged. Neurologic examination on this date showed no evidence of disease in the central or the peripheral nervous system, and the only diagnosis was toxic encephalitis secondary to acute otitis media (on the left). At the time of writing (Sept. 1, 1938) the child is in good health.

COMMENT

The evidence of well marked meningitis on admission and the finding of streptococci in the spinal fluid warranted a poor prognosis in this case, and such a prognosis was given. However, surgical intervention seemed to offer the only hope. I was greatly surprised the following morning to find the boy conscious, and immediately started treatment with sulfanilamide. This remarkable improvement, along with the marked reduction of bacteria in the spinal fluid, casts some doubt on the exact role played by sulfanilamide here, and it cannot be doubted that the boy had a marked resistance to the organisms. It is possible that he might have been one of the 3 per cent that recover from this disease spontaneously. However, it is well known that initial recovery is not always sustained, and it is probable that the drug acted to prevent a recurrence of the infection, or, possibly, an abscess of the brain or an arachnoid cyst. Since in the human subject it is impossible to evaluate various therapies experimentally, one can only conjecture as to the value of each in this case, but the experimental work of Kolmer and others leads one to believe that sulfanilamide is of value in the treatment of streptococcic meningitis. Certainly it should be used in every case, and until its true value is known all cases of recovery after its use should be reported.

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Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology

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PERORAL ENDOSCOPY

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BRONCHOSCOPY

Pulmonary Physiology.—With the advent of bronchoscopy bronchial movements have been observed and studied. Recently certain observations were made and recorded graphically by Paul Frenckner, who devised a special bronchoscope and carried out bronchospirometric studies.

Brighton and Barach [1] described the technic of employing the double bronchoscope developed by Frenckner for the study of the ventilation of each lung. The procedure is capable of providing accurate determination of the function of each lung in respect to consumption of the oxygen, the volume of ventilation and the velocity of air movement. Previously reported results indicate that this test is of importance clinically, as, for example, in the demonstration of adequate pulmonic function in cases of pulmonary tuberculosis in which radical collapse of the opposite lung is contemplated. Furthermore, the field of pulmonary physiology is extended by this method, which has made possible the separation of the ventilatory behavior of each lung.

Brunetti [2] devised a method of recording bronchial movements by combining the technics of bronchospirometry and bronchoscopy. The distal portion of a bronchoscope, just above its distal orifice, is equipped with a small distensible balloon; this connects through the bronchoscope with a pressure expansion chamber and the latter with a pointer and kimograph. Dogs anesthetized with chloral hydrate and morphine were

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1. Brighton, G. R., and Barach, A. L.: Bronchospirometry, Ann. Otol., Rhin. & Laryng. **47**:1061 (Dec.) 1938.

2. Brunetti, F.: The Active Movements of Bronchi and the Naso-Bronchial Reflex: Its Recording by a Bronchopneumographic Method, Arch. ital. per le mal. d. trachea-bronchi, esophago **17**:213 (Oct.-Dec.) 1938.

used. Normally the movements had a regular rhythm; mechanical stimulation of the nasal mucosa interfered with the amplitude and duration of the contractions. Inspiration is normally followed by a series of clonic bronchial contractions brought about by the smooth muscle of the lung, which is distended during the inspiratory phase. The author speculated on the changes in this reflex in pathologic conditions such as asthma.

Diagnosis.—Great difficulty is often experienced in determining the site and cause of bleeding from the tracheobronchial tree, in spite of frequently repeated roentgenologic studies and physical examinations.

Gerlings and Polak [3] reported 2 cases of telangiectasis in the tracheobronchial tree, which bled readily on light touch. The first patient, a woman of 26, had had frequent attacks of hemoptysis, with no clinical, bacteriologic or roentgenographic evidences of tuberculosis. She had small varices not only in the mucous membrane of the trachea but on the soft palate and lips and about the mouth and face. The second patient, a man aged 41, spat blood often, had many nosebleeds and was under suspicion of being tuberculous. On two or three occasions he had severe hemoptysis. The father had a similar history. Over his lips were many small varicosities. Bronchoscopic examination revealed a small bleeding angioma in the trachea near the bifurcation and another in the bronchus to the lower lobe of the right lung. Cauterization with chromic acid stopped the bleeding permanently.

In addition to being indispensable for the extraction of foreign bodies from the air passages, Holinger [4] stated, the bronchoscope is a valuable aid in the diagnosis and treatment of bronchial obstruction and suppurative diseases of the bronchi and is often the only means of securing diagnostic data on obscure pulmonary lesions. It is a necessary part of or addition to the armamentarium of any physician studying lesions of the respiratory tract, and its use is an invaluable supplement to other diagnostic procedures.

According to Soulas,[5] the bronchial system often reflects the state of even remotely located pathologic processes in the lung. With tumors of the lung, bronchoscopic procedure may (1) make it possible to see the tumor, remove a piece of it and relieve obstruction or bleeding caused by it, (2) disclose the "endobronchial tableau" of a neoplasm, such as deep red color of the mucosa, stenosing infiltration, bleeding at the surface and

3. Gerlings, P. G., and Polak, A.: Tracheobronchial Type of Osler's Hemorrhagic Angiomatosis, Bronchoscop., œsophagoscop. et gastroscop., July 1938, p. 175.

4. Holinger, P. H.: Bronchoscopy in Relation to Diseases of the Respiratory Tract, Illinois M. J. **74**:228 (Sept.) 1938.

5. Soulas, A.: Role of Bronchoscopy in Surgery of Tumors and Abscesses of the Lung, Bronchoscop., œsophagoscop. et gastroscop., October 1938, p. 223.

sharply limited swelling of the wall, (3) give almost negative results except for disclosing a certain abnormality of the movements of the bronchus and an obliquity in its direction or (4) reveal a tumor associated with suppuration.

Bronchoscopic examination often reveals the causes and mechanism of bronchial obstruction and has permitted one to understand its end results, atelectasis or emphysema. In the treatment of abscesses of the lung, bronchoscopic procedure is of great value, particularly for recent abscesses and as a preparatory measure for those requiring surgical intervention. For bronchiectasis, after endobronchial disturbance is ruled out, bronchoscopic drainage may be only palliative. After operation, it may be required to combat the effects of sudden inundation of the tracheobronchial tree by purulent secretions.

For bronchoscopic investigation of chronic nontuberculous infections of the lungs the operator should not only be able to perform an examination which is technically adequate but also possess a thorough knowledge of pulmonary disease. The bronchoscopist, therefore, should be a consultant as well as a technician. Samson [6] discussed the value of bronchoscopic procedure for chronic pulmonary abscess, chronic suppurative pneumonitis and chronic bronchiectasis. He described in detail the indications for the use of the bronchoscope as a diagnostic and therapeutic procedure in these conditions. The role of localized and diffuse bronchial and bronchiolar obstruction was emphasized with reference to the establishment and maintenance of bronchopulmonary suppuration. Every patient with any type of bronchopulmonary suppuration should have at least one bronchoscopic examination as a diagnostic procedure, and many should receive a series of bronchoscopic treatments before radical surgical intervention finally is decided on.

Acute Laryngotracheobronchitis.—The mortality from acute laryngotracheobronchitis was reduced 50 per cent by using adequate treatment, which included tracheotomy and frequent bronchoscopic procedures, according to a report of 45 cases by Brennemann and others.[7] Frequently no treatment is satisfactory, but emphasis was placed on the constant care needed for young children and the necessity of having a bronchoscopist available to aspirate secretions when they become thick, crusty and obstructive. The gravest pathologic finding is the marked subglottic swelling; relief can be obtained by aspiration through either the bronchoscope or a tracheotomy tube.

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6. Samson, P. C.: Bronchoscopy in Chronic Nontuberculous Infections of the Lungs, Am. Rev. Tuberc. **38**:688 (Dec.) 1938.

7. Brennemann, J.; Clifton, W. M.; Frank, A., and Holinger, P.: Acute Laryngotracheobronchitis, Am. J. Dis. Child. **55**:667 (April) 1938.

Acute laryngotracheobronchitis remains one of the most serious conditions that has to be dealt with in children. Richards [8] has shown that in spite of the best known methods of treatment the mortality is greater than 50 per cent. Tracheotomy, followed when need arises by bronchoscopic aspirations for removal of any obstructing material, is recommended. Further studies of the pathologic changes in the tracheobronchial tree and the trial of systemic therapy with drugs are necessary to produce a sizable reduction in mortality.

Pulmonary Abscess.—In analyzing 100 consecutive fatal cases of nontuberculous pulmonary abscesses Rives, Major and Romano [9] stated the belief that the high mortality was caused chiefly by spreading pneumonitis, empyema and anemia. For the best results supportive measures, surgical drainage and bronchoscopic aspiration should be utilized according to their proper indications. The neglect of bronchoscopic procedures is considered one of the factors contributing to the mortality.

A case of hematogenous amebic abscess of the lung followed by acute abscess of the brain was reported by Putney and Baker.[10] Prompt healing of the pulmonary lesion was obtained by repeated bronchoscopic drainage plus specific medication.

Bronchiectasis.—In discussing the development of bronchiectasis, Holinger [11] emphasized the need of recognizing those forms of bronchial inflammation which, producing bronchial obstruction and atelectasis, eventuate in bronchiectasis unless prompt relief is afforded. The sequence of these developments was discussed, and comparisons were made between a group of patients with bronchiectasis who were observed from the onset of the pulmonary disease and followed to fully developed bronchiectasis and a similar group observed early and treated bronchoscopically in whom the process was aborted.

Persistent pulmonary findings simulating pneumonia are frequently due to atelectasis. Inflammatory bronchial stenosis was found to be responsible for the production of the original atelectatic pulmonary lesion. If the lung does not clear spontaneously, early and frequent bronchoscopic drainage of the involved bronchi will prevent permanent dilatation and destruction of the bronchial walls, which follows if atelectasis is left untreated.

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8. Richards, L.: A Further Study of the Pathology of Acute Laryngotracheobronchitis in Children, Ann. Otol., Rhin. & Laryng. **47**:326 (June) 1938.

9. Rives, J. D.; Major, R. C., and Romano, S. A.: Lung Abscess, Ann. Surg. **107**:753 (May) 1938.

10. Putney, F. J., and Baker, D. C., Jr.: Amoebic Abscess of the Lung Complicated by Cerebral Abscess, Dis. of Chest **4**:20 (Aug.) 1938.

11. Holinger, P. H.: The Role of Inflammatory Stenosis in the Etiology of Bronchiectasis, Ann. Otol., Rhin. & Laryng. **47**:1070 (Dec.) 1938.

Bendove and Deren [12] demonstrated that acute pneumonitis is sometimes the first indication of the presence of bronchiectasis. Dilated bronchi were observed on bronchograms as early as two days after the onset of a pneumonic process. Many patients remained practically symptom free between attacks of pulmonary inflammation, which usually began with infection of the upper part of the respiratory tract. Acute peribronchiectatic pneumonitis rarely manifested severe toxic symptoms, although extensive consolidation was shown on the roentgenograms; the marked constitutional reactions invoked by the exacerbations of suppurative bronchiectasis form a striking contrast. The acute pulmonic lesion healed by resolution within two weeks leaving permanent bronchial dilatations.

In studying a series of cases of bronchiectasis to ascertain means of prevention as well as early diagnosis, Raia [13] observed that infection and obstruction seemed to play the chief role in the production of anatomic and physiologic pulmonary damage. While this may be of such severity as to result in acute bronchiectasis, more often it results in low grade chronic inflammation of the bronchi which renders them less resistant to subsequent infection. Eventually dilatation of the bronchi may develop unless proper protective measures are undertaken. While the employment of iodized oil is invaluable in determining the extent and degree of bronchial dilatation, it nevertheless has definite limitations. Information cannot be secured concerning the degree of fibrosis or the functional insufficiency of damaged mucous glands which may result in impaired health. In the final analysis the determining factor must be the functional capacity of the lung, even when anatomic changes cannot be determined clinically.

In supplying an explanation for the frequent association of bronchiectasis and infection of the upper part of the respiratory tract, Hodge [14] directed attention to several significant factors. He contended that bronchiectasis begins as an atelectatic condition of the lungs and infection is superimposed. The infection may frequently be supplied by disease of the upper respiratory tract, originating primarily in the nasopharynx and extending secondarily to the sinuses and the lower respiratory system. Bronchial dilatations demonstrated by roentgen studies are regarded as dilatations not only of the bronchi but also of the bullae, resulting from a compensatory effort of the lung to overcome the obstruction. When clinical bronchiectasis develops, the contributing cause is infection from above with resulting edema and pneumonitis in already obstructed pulmonary tissue.

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12. Bendove, R. A., and Deren, M. D.: Acute Peribronchiectatic Pneumonitis, New York State J. Med. **38**:1273 (Oct. 1) 1938.

13. Raia, A.: Bronchiectasis in Children, with Special Reference to Prevention and Early Diagnosis, Am. J. Dis. Child. **56**:852 (Oct.) 1938.

14. Hodge, G. F.: Some Factors in the Relationship of Upper Respiratory Infection and Bronchiectasis, J. Laryng. & Otol. **53**:485 (Aug.) 1938.

Pulmonary Suppuration.—In discussing the treatment of pulmonary suppuration, Moore [15] recorded his experience with bacteriophage employed in conjunction with bronchoscopic procedure. A bacteriophage known to be active against two strains of Streptococcus haemolyticus is pooled with a polyvalent phage active against Staphylococcus aureus. The lysate is checked for sterility, bottled and then rechecked for activity and sterility. After thorough bronchoscopic aspiration of the infected areas and dilation of any stenosed passage, about 5 cc. of bacteriophage is instilled. This procedure usually is repeated at weekly intervals. Improvement was noted in a number of the cases reported but probably was no greater than that observed in patients who have been under general medical care with postural drainage and bronchoscopic aspiration.

Tuberculosis of the Trachea and of the Bronchi.—Warren and his associates [16] reviewed the results of bronchoscopic examination of a series of 198 tuberculous patients. In the 74 patients found to have tracheobronchial tuberculosis, a majority of the lesions existed either as granulation tissue or as discrete ulceration. Other forms, including cicatricial stenoses, ulcerostenoses, tuberculomas and diffuse inflammation of the mucosa, were noted. Local treatment seemed to have benefited the patients, and the authors advocated three methods, namely, cauterization of ulcerations or granulations, removal of tuberculomas and dilation of stenoses. The 6 deaths recorded appeared to have been due to the extent of parenchymal involvement rather than the severity of the bronchial disease. In 57 cases tuberculous bronchitis or tracheitis was treated. Of this number, the lesion healed in 34, progressed or did not improve in 10 and still is under treatment in 9. In the authors' experience, tuberculous tracheobronchitis responded favorably to electrosurgical and chemical cauterization. There were 31 patients whose sputum gave a positive reaction in spite of the apparent control of the parenchymal disease. Healing of the bronchial lesion was followed by prompt conversion of sputum in 22 of the 26 cases in which it occurred.

While evidences of bronchial obstruction constituted the indications for bronchoscopic procedure in a majority of the cases, the authors expressed the opinion that hemoptysis unexplained on the basis of peripheral lesions or the presence of acid-fast bacilli in the sputum and variations in its amount and character can be considered definite indications.

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15. Moore, W. F.: Bronchoscopic Treatment of Pulmonary Suppuration with Special Reference to Use of Polyvalent Stock Bacteriophage, Pennsylvania M. J. **41**:272 (Jan.) 1938.

16. Warren, W.; Hammond, A. E., and Tuttle, W. M.: The Diagnosis and Treatment of Tuberculous Tracheobronchitis, Am. Rev. Tuberc. **37**:315 (March) 1938.

Several methods of approach for the treatment of tuberculosis of the trachea and bronchi have been suggested by Kernan.[17] Treatment of ulceration of the tracheobronchial tree is directed toward prompt healing with the formation of a minimum of scar tissue. To accomplish this, immobilization of the lung by pneumothorax and direct treatment of the ulcerated area, preferably by the mercury vapor lamp, are recommended. For tuberculous stricture, either the passage is closed by coagulation, provided the lung distal to the stenosis is dry, or dilation is used to insure patency of the bronchi and drainage of the secondary infection. Obstructing tuberculous tumors should be removed by coagulation. Pedunculated tumors, producing obstruction and causing a flapping sound during respiration, are best treated by electrocoagulation; thus one avoids stripping the mucous membrane. Tuberculous tumors may also produce obstruction to a bronchial orifice, with resulting obstructing emphysema or obstructive atelectasis. It is important to be aware of this fact when contemplating pneumothorax therapy, for in the presence of obstructive emphysema it may not be possible to compress a lobe or lobes.

Reduction of involved lymph nodes may be accomplished by roentgen therapy. Spontaneous rupture of a suppurating node requires aspiration, and solid portions must be removed like any other foreign body. Kernan also discussed the question of incision through the bronchial wall to allow drainage of tuberculous mediastinal abscesses or removal of obstructing mediastinal nodes.

Davison [18] employed an electrocoagulation current of weak intensity in the treatment of tuberculous tracheobronchitis with uniformly good results. Eight patients were treated, in all of whom the lesions had been present for some time and exhibited little tendency to heal. Bronchoscopic treatments were carried out at intervals of two to four weeks without noticeable harmful effects. There were no laryngeal complications, and spread of the parenchymal lesions was not observed. In each case the lesion consistently tended to heal. Six patients were clinically well at the time of the report; 1, still under treatment, was improving rapidly. For the remaining patient, because of extreme debility, treatments were discontinued, although they had produced regression of the bronchial lesions.

Roentgen studies and diagnostic bronchoscopic investigations are essential in arriving at a diagnosis of bronchial stenosis due to enlarged mediastinal lymph nodes. In Schneider's case [19] the observations at

17. Kernan, J. D.: Treatment of Tuberculosis of the Trachea and Bronchi, Ann. Otol., Rhin. & Laryng. **47**:306 (June) 1938.

18. Davison, F. W.: The Treatment of Tuberculous Tracheobronchitis, Ann. Otol., Rhin. & Laryng. **47**:826 (Sept.) 1938.

19. Schneider, L. T.: Bronchial Occlusion Due to Tuberculous Lymphadenitis, Am. Rev. Tuberc. **38**:320 (Sept.) 1938.

clinical examination suggested a foreign body or bronchial asthma, but the bronchoscopic findings were those of compressive stenosis of the right main bronchus, which was subsequently proved to be caused by tuberculous tracheobronchial lymphadenitis.

In summing up his experience with the use of the bronchoscope for tracheobronchial tuberculosis, Myerson [20] expressed the opinion that its value is principally diagnostic in cases of tuberculosis of the trachea and bronchi. The bronchoscopist is able to localize the cause of the atelectasis by finding an obstructive tuberculoma or fibrotic lesion and to take smears from each bronchial orifice to ascertain from which lobes the infected sputum is coming, but except for the coagulation and cauterization of tuberculomas and the searing of inactive ulcers, he can do little of positive value in these cases. Silver nitrate should not be used in solutions stronger than 5 per cent; in solutions of 10 per cent or stronger it has a destructive effect. Strictures cannot be dilated because of the type of cicatricial tissue which is present and because of their length. The average dilator is easily broken by the resistance of the firm fibrous tissue. In addition, the possible presence of an active lesion in the subepithelial and peribronchial tissues makes dilation dangerous. Aspiration is of value for the removal of secretions which are retained beyond obstructive lesions in the bronchi. Unfortunately its value is only temporary, since the secretions reform within a few hours and bronchoscopic procedure at intervals frequent enough to keep the involved area clear is not practical. Ultimate healing and recovery depend more on the ability of the tissues to react and heal than on the therapy employed.

Postoperative Pulmonary Complications.—Haight [21] stated that he considered the employment of constant intratracheal suction essential for the prevention and treatment of postoperative pulmonary complications. Unsuccessful conservative measures to facilitate bronchial drainage have been followed by either bronchoscopic procedures or aspiration through an intranasal catheter. Ineffectual cough or retention of secretions is a sufficient indication for mechanical bronchial suction. Mention was made of the judicious use of drugs, particularly narcotics, and the importance of posture in prevention of pulmonary complications.

Three cases of bronchial obstruction following some surgical procedure are presented by Holinger.[22] The first was a case of pulmonary atelectasis; bronchoscopic examination showed both main bronchi filled

20. Myerson, M. C.: The Limitation of Bronchoscopy in the Treatment of Tracheobronchial Tuberculosis, Ann. Otol., Rhin. & Laryng. **47**:723 (Sept.) 1938.

21. Haight, C.: Intratracheal Suction in the Management of Postoperative Pulmonary Complications, Ann. Surg. **107**:218 (Feb.) 1938.

22. Holinger, P. H.: Bronchoscopy in Postoperative Pulmonary Complications, S. Clin. North America **18**:237 (Feb.) 1938.

with thick, tenacious secretion and the lumen of the right main bronchus completely occluded. In the second, pulmonary obstruction was due to a foreign body (tooth) which lodged in the left main bronchus after tonsillectomy. The third was an instance of bilateral postoperative pulmonary abscesses with recovery following bronchoscopic procedure.

Tumors of the Trachea and of the Bronchi.—Benign Tumors: Benign growths of the tracheobronchial tree were regarded as rare prior to the employment of bronchoscopic examination. The Jacksons [23] discussed the incidence, etiology, pathology, symptomatology and treatment. Pitfalls in diagnosis are due to delay or failure in availing oneself of the information obtained by diagnostic use of the bronchoscope. Pitfalls in bronchoscopic removal of benign growths are almost all avoidable by conservatism, caution and the utmost delicacy of touch.

Some benign endobronchial tumors are fatal, primarily, by asphyxia, or secondarily, by the sequential suppurative disease of the lung. Almost all benign endobronchial tumors and tumor-like formations can be removed bronchoscopically, and the prognosis for life in such cases is good. Recurrence is a possibility, especially in cases of lymphoma and papilloma; with papilloma and some forms of granuloma new growths may appear at new locations after removal of the primary growth. In such cases reappearances usually cease after repeated superficial removals. The prognosis of benign adenoma is good provided the patient is seen occasionally in order to detect and treat recrudescence or recurrence early.

Brock [24] discussed some of the common types of benign bronchial tumor, the most frequently encountered being the so-called adenomatous polyp. All benign bronchial tumors exhibit a marked tendency to bleed and to produce secondary pulmonary changes by causing obstruction followed by infection. For treatment the author recommends removal with forceps followed by the application of radon to the involved area.

Osteochondroma of the Bronchi: Gebauer [25] reported a case of osteochondroma of the bronchus to the lower lobe of the right lung in a man aged 44. Although there was a history of frequent colds, the occurrence of severe hemoptysis for a period of five days directed attention to the presence of disease of the chest. The tumor almost completely occluded the right main bronchus and appeared as a hard corrugated mass. After its removal by bronchoscopic procedure there was no evidence of recurrence.

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23. Jackson, C., and Jackson, C. L.: Benign Tumors and Tumor-Like Conditions in the Tracheobronchial Tree, Am. J. Surg. **42**:275 (Oct.) 1938.

24. Brock, R. C.: Pulmonary New Growths: Pathology, Diagnosis and Treatment, Lancet **2**:1041 (Nov. 5); 1103 (Nov. 12) 1938.

25. Gebauer, P. W.: A Case of Osteochondroma of the Bronchus, Ohio State M. J. **34**:398 (April) 1938.

Chondroma of the Lung: Cracovaner [26] has added 2 cases of chondroma of the lung to the literature. In both cases the tumor was located and removed by the use of the bronchoscope, with relief of the bronchial obstruction and the symptoms produced by it.

Carcinoma of the Trachea and of the Bronchi: That absence of early symptoms undoubtedly accounts for delay in directing attention to carcinoma of the trachea is the opinion of Culp.[27] The ready accessibility of the trachea to direct examination should lead to early diagnosis if disease is suspected. Having collected a series of 433 recorded cases of primary tracheal neoplasms, in 34 per cent of which the lesion was carcinoma, Culp has added 2 personally observed cases to the latter group. The available statistics on autopsies indicate the infrequence of primary malignant growth in the trachea, the squamous cell variety and adenocarcinoma being equally common. Males seem to predominate among those affected by this disease, which usually originates in the lower third of the trachea, particularly on the posterior wall. Metastasis occurs early in any of the tissues or organs of the body, resulting in a poor prognosis regardless of the treatment instituted.

The largest single series of carcinomas of the bronchi reported to date, 164 cases, is that of Stein and Joslin.[28] They noted an increase in the number of cases in which bronchial carcinoma has been recognized; whether occurrences have increased is still speculative. Obstruction of a bronchus with its associated pathologic changes accounts for the usual symptoms and is demonstrated roentgenologically most commonly as some degree of atelectasis. It is of interest to note that of the 164 cases a diagnosis was established by postmortem examination in 100 and by the use of the bronchoscope with biopsy in but 21.

The tumors studied by either histologic or postmortem examination revealed an almost even distribution of cancer cells between the squamous, the glandular and the undifferentiated variety. Since most of the growths originate in the larger bronchi surgical treatment generally necessitates total pneumonectomy. For the large number of far advanced growths that are seen only irradiation therapy, as a palliative measure, can be given.

Although cancer of the lung is relatively common, operation is seldom performed, because the diagnosis commonly is made when the disease is

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26. Cracovaner, A. J.: Chondroma of the Lung: Report of Two Cases, Laryngoscope **48**:346 (May) 1938.

27. Culp, O. S.: Primary Carcinoma of the Trachea, J. Thoracic Surg. **7**: 471 (June) 1938.

28. Stein, J. J., and Joslin, H.: Carcinoma of the Bronchus: A Clinical and Pathological Study of One Hundred and Sixty-Four Cases, Surg., Gynec. & Obst. **66**:902 (May) 1938.

advanced. Allison and Stanbury [29] described 2 cases of carcinoma of the lung in which the diagnosis was suggested by the clinical and roentgen findings and was confirmed by bronchoscopic examination and biopsy. They expressed the opinion that only by frequent use of the bronchoscope can early disease be discovered.

The outlook for the cure of malignant pulmonary tumors is unfavorable, according to Brock.[24] The most satisfactory results are obtained by removal of the entire lung with the adjacent lymph nodes, although the incidence of operability is not high. The method next in order of preference is intrabronchial insertion of radon seeds rather than high voltage roentgen therapy, for the latter destroys tissue extensively when administered in sufficient doses. Complete cure by the application of radon is not anticipated. Local destruction of the growth is accomplished to prevent complications.

A case of bronchogenic carcinoma with cough, expectoration and hemoptysis was reported by Orton.[30] The entire left lung was atelectatic; on bronchoscopic examination a lesion of the left main bronchus below the orifice of the branch to the upper lobe of the lung was noted. The diagnosis was proved by biopsy of material removed with the bronchoscope. Examination after death showed extensive parenchymal involvement of the left lung with remarkable metastases to the heart and pericardium and extension to the liver.

The bronchographic appearances of malignant bronchial stenosis as described by Farinas [31] are especially important in the diagnosis of a malignant growth that extends beyond the view of the bronchoscopist. The filling defect produced by a polypoid carcinoma exhibits localized irregular stenosis with ragged borders, whereas the infiltrating type forms a fixed concentric defect. Bronchial dilatation is always seen below the area of stenosis.

Primary Sarcoma: Sarcoma originating in the lung is rare. It commonly has its origin in peribronchial or interalveolar connective tissue and therefore is not often observed as a bronchial tumor. Stenosis of a bronchus, when present, usually is compressive in origin. In the case reported by Baum and others [32] thoracic signs of obstructive atelectasis of the lower lobe of the right lung indicated obstruction of the

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29. Allison, P. R., and Stanbury, W. S.: Carcinoma of the Lung, Lancet **2**: 1165 (Nov. 19) 1938.

30. Orton, H. B.: Bronchogenic Carcinoma: A Case Report, Ann. Otol., Rhin. & Laryng. **47**:795 (Sept.) 1938.

31. Farinas, P. L.: Malignant Bronchial Stenosis: Bronchographic Aspect, Am. J. Roentgenol. **40**:180 (Aug.) 1938.

32. Baum, O. S.; Richards, J. H., and Ryan, M. D.: Atelectasis of the Right Lower and Middle Lobes with Bronchoscopy Demonstrating Spindle Cell Sarcoma of Right Main Bronchus, Ann. Int. Med. **12**:699 (Nov.) 1938.

right main bronchus. The patient, a woman aged 29, had been ill for six weeks. A diagnosis of pneumonia and pleurisy had previously been made. There were fever with cough, slight sputum, never blood tinged, and sharp pains in the right side of the chest. Roentgen studies of the chest corroborated the clinical diagnosis of obstructive atelectasis.

At bronchoscopic examination soft friable polypoid tissue was found occluding the right main bronchus. Practically all the tissue was removed with forceps and suction. The thoracic signs strikingly improved within twenty-four hours after bronchoscopic removal of the growth; the right lung appeared normal to physical and fluoroscopic examination. A roentgenogram made five days later revealed a normal chest. The histologic diagnosis was spindle cell sarcoma. Irradiation had been instituted, but too little time had elapsed to warrant an expression regarding the prognosis.

Scleroma of the Trachea: It is important to remember the possibility of scleroma in patients who have chronic lesions of the nose, the pharynx, the larynx or the trachea that in many respects simulate those of ozena, syphilis, granuloma or malignant tumor, individually or combined.

In reporting cases of scleroma, Morrison [33] described a man aged 26 who for two years had been complaining of various disorders of the nose and throat. A diagnosis of scleroma was made on the basis of the nasal and pharyngeal lesions. The larynx appeared practically normal. The dyspnea complained of was explained by the presence of a cicatricial diaphragm about 1 cm. below the level of the vocal cords. The condition terminated fatally, and permission for a postmortem examination was secured. This revealed, in addition to the nasal and pharyngeal lesions, an apparent absence of pathologic changes in the larynx itself, marked thickening of the tracheal walls, dense cicatricial diaphragms encroaching on its lumen and dilatation of the lower third of the trachea and of the right and the left main bronchus.

Complications of Roentgen Therapy.—While there may be justification for intense irradiation, with ensuing complications, in the treatment of carcinoma, there is grave question concerning the desirability of employing such measures in great amount as an elective treatment for conditions compatible with life. Clerf and Putney [34] discussed this question and reported 2 cases in which exophthalmic goiter was treated by irradiation and disabling tracheal lesions later developed without laryngeal involvement. In 1 case tracheotomy became necessary because of obstructive dyspnea. A granuloma found partially occluding the

33. Morrison, L. E.: Scleroma (Rhinoscleroma), Arch. Otolaryng. **28**:531 (Oct.) 1938.

34. Clerf, L. H., and Putney, F. J.: Tracheal Stenosis from Roentgen Therapy, Ann. Otol., Rhin. & Laryng. **47**:666 (Sept.) 1938.

trachea was removed bronchoscopically. In a second case there was tracheal stenosis with atrophic mucosal changes and crusting. Cough was troublesome, and at times dyspnea was distressing. The prognosis in this case was not considered favorable, although there has been some improvement under local treatment. Inquiry might be made whether irradiation has a place in the treatment of exophthalmic goiter and whether, if so, proper precaution can be exercised to avoid trophic reactions which are disabling and may terminate fatally.

Foreign Body in the Bronchi.—Three cases of intentional introduction of foreign bodies into the air passages were reported by Greif and others.[35] The first was that of a prisoner who had swallowed different objects and who finally forced a loop of 2 mm. wire into the left main bronchus. The second case also was that of a prisoner addicted to swallowing objects; he introduced a loop of wire 3 mm. in diameter into the right main bronchus, where it lodged. The last case was that of a man aged 27 who five years previous to being observed had introduced into his pharynx the metallic handle of a spoon, which he thought he had swallowed. For only two months before admission to the hospital did the patient present any symptoms; at that time cough, expectoration, fever, gastralgia and pain in the chest occurred. A roentgen study disclosed the handle of the spoon in the right main bronchus, with pneumonia and abscesses in the middle and the lower lobe of the lung. Extraction of the foreign body did not prevent death five days later. In the 2 other cases extraction was uneventful.

In 1 of these cases introduction of the object into the trachea was due to poor orientation on the patient's part because of marked paresthesia of the pharynx; in the other, to the too forceful maneuver of the patient to overcome pharyngeal spasm. Each of the patients intended to introduce the object into the esophagus. Any patient suspected of having swallowed a foreign object ought to have a roentgen examination of the chest, even though he does not present pulmonary symptoms.

Vlavacek and Masek[36] reported the case of a boy who nine years before coming under their care had aspirated a collar button; pulmonary abscess and empyema had developed on the right side, for which a rib was resected. Drainage of the abscess did not relieve the symptoms; bronchoscopic examination revealed stenosis of the right main bronchus

35. Greif; Hlavacek, V., and Wiskovksy, B.: Three Cases of Foreign Body in the Bronchus Following Attempt at Intentional Introduction of the Object in the Stomach, Bronchoscop., œsophagoscop. et gastroscop., April 1938, p. 115.

36. Vlavacek and Masek, J.: Chronic Inclusion of a Foreign Body as a Cause of Bronchostenosis and Grave Pulmonary Complications, Bronchoscop., œsophagoscop. et gastroscop., April 1938, p. 100.

about 4 cm. below the bifurcation. Below the stenosis a collar button was found. Extraction of the button was followed by complete recovery.

A case of subcutaneous emphysema resulting from the aspiration of fragments of wood after an accident was reported by Daily.[37] Tracheotomy was necessary, and at bronchoscopic examination several fragments of wood were removed from the right main bronchus. An area of granulation tissue at the orifice of the left main bronchus was noted and thought to be the site of perforation from which the emphysema of the left side of the face, neck and chest developed. After a prolonged illness the child recovered.

In a report of a series of animal experiments carried out by Weinberg[38] to determine the pathologic changes produced by organic and inorganic foreign bodies in the tracheobronchial tree, the early and late manifestations were discussed. The pulmonary changes resulting within the first few days from the lodgment of vegetal substances are dependent on the chemical nature of the invader, while those caused by inert material may be attributed to trauma and ulceration incident to their lodgment. The late effects of the aspiration of a foreign body are purely mechanical and vary, according to the degree of bronchial occlusion, from small hemorrhagic areas and localized suppuration to massive atelectasis terminating in bronchiectasis.

Hill[39] discussed 7 cases of vegetal bronchitis caused by foreign bodies (peanut, bean, apple pulp, celery). The production of this condition depends on mechanical and chemical factors, time and the age of the patient. In 3 of the cases the termination was fatal despite removal of the foreign body, tracheotomy and adequate postoperative care. The severest reactions resulted from large foreign bodies that produced complete bronchial obstruction and from those containing irritative vegetable oils.

By inundation of the tracheobronchial tree is meant the sudden invasion of this area by secretions originating either from outside the respiratory tract, such as vomitus and alimentary liquids, or from the lung itself, such as blood and pus from an abscess or from a tuberculous cavity. This results in a sudden obstruction of the trachea. Soulas[40] reported 2 cases in which emergency bronchial aspiration was performed. In 1 there was an inferior cervical abscess extending into the

37. Daily, L.: A Very Unusual Case of Subcutaneous Emphysema Caused by a Foreign Body, Ann. Otol., Rhin. & Laryng. **47**:831 (Sept.) 1938.

38. Weinberg, J.: Bronchial Obstruction Produced by Organic and Inorganic Foreign Bodies, J. Thoracic Surg. **7**:488 (June) 1938.

39. Hill, F. T.: A Consideration of Some of the Causative Factors of Vegetal Bronchitis, Ann. Otol., Rhin. & Laryng. **47**:814 (Sept.) 1938.

40. Soulas, A.: Cases of Tracheobronchial Inundation, Bronchoscop., œsophagoscop. et gastroscop., July 1938, p. 140.

mediastinum and draining into the hypopharynx. Aspiration relieved the asphyxia, though it did not prevent a fatal result. The other patient, with bilateral pulmonary tuberculosis, also was relieved of acute symptoms of suffocation by drainage through a tube of the pus flooding the trachea.

DISEASES OF THE ESOPHAGUS

Foreign Body.—Arbuckle and Stutsman [41] condemned blind bougienage and advocated the removal of all large open safety pins with point up in the esophagus by endogastric version under direction of the biplane fluoroscope. They reported 5 cases, all of children, with 2 fatalities. In 1 case a stomach tube was passed, and death resulted in twenty-four hours from hemorrhage due to a large tear in the internal jugular vein. The other patient who died had a pneumonic consolidation of the lower lobe of the right lung and empyema from an open safety pin in the esophagus at the level of the tracheal bifurcation. There had been no previous attempt at removal, and endogastric version successfully removed the foreign body; the concomitant infection, caused by previous perforation with the pin, resulted in death.

Dysphagia.—Dysphagia caused by esophageal narrowing from exostoses of the spinal column is so infrequently encountered that the case which Iglauer [42] reported is added to only 6 previously recorded cases. Surgical intervention was employed in this instance with complete relief of symptoms. An incision in the lateral surface of the neck furnished sufficient exposure for removal of the long tumor from the cervical spine.

In the report of a case of postcricoid carcinoma in a woman aged 54 Johnson [43] emphasized the importance of the history in such cases. In his case there was a history of dysphagia for more than twenty-five years. The patient always had been frail and underweight and had been treated for anemia over many years. There was a history of dental trouble, and the last teeth were extracted when she was 41. Seven years previously a web in the upper part of the esophagus was discovered at esophagoscopic examination. There were fissures at the corners of the mouth, and the tongue was smooth. The history and the findings exclusive of the postcricoid carcinoma were those observed in the Plummer-Vinson syndrome. Owing to the pathologically altered mucosa this syndrome should be considered a precancerous state. John-

41. Arbuckle, M. F., and Stutsman, A. C.: Safety-Pin in the Alimentary Tract, South. Surgeon **7**:131 (April) 1938.

42. Iglauer, S.: A Case of Dysphagia Due to an Osteochondroma of the Cervical Spine, Osteotomy, Recovery, Ann. Otol., Rhin. & Laryng. **47**:799 (Sept.) 1938.

43. Johnson, L.: Certain Considerations on Dysphagia Associated with Anemia, Ann. Otol., Rhin. & Laryng. **47**:809 (Sept.) 1938.

son emphasized the need of recognizing the important symptoms, dysphagia, hypochromic anemia, atrophic changes of the mucosa of the lips, mouth and tongue, fissuring at the angles of the mouth, early loss of teeth, frequent changes in the nails and splenomegaly, as the Plummer-Vinson syndrome, a precancerous state, and instituting prompt and appropriate treatment.

Stricture of the Esophagus.—Phelps [44] advocated early treatment of all chemical burns of the esophagus to prevent formation of a stricture. Early bougienage and dilation are not apt to cause perforation and should be systematically performed for many months. Any type of rubber bougie or stomach tube is effective, but it is well to inspect the lesion through an esophagoscope before instituting treatment.

In a discussion of the treatment of stricture of the esophagus, Heatly [45] emphasized the ease with which the esophagus may be perforated. This must be constantly in the minds of those undertaking the treatment of any type of esophageal stricture. The method employed should vary to some extent with the experience of the physician himself. It is imperative that the general condition of the patient receive primary consideration before local measures are attempted. Careful visual or string guidance and the avoidance of blind, overrapid or excessive dilations, as well as conscientious observation for months after the conclusion of active treatment are imperative if successful results are to be secured.

Attention was directed by Benedict and Daland [46] to the development of esophageal stricture following duodenal ulcer. In their patient acute esophagitis developed in the lower third of the esophagus five weeks after gastric resection for duodenal ulcer. Substernal pain was absent, and the appearance of the esophagus by both roentgen and esophagoscopic examination suggested that the stenosis followed acute esophagitis rather than peptic ulcer of the esophagus. Esophagoscopic bougienage was instituted, and dilatation was secured promptly, so that the patient was able to return to a liquid diet and later could swallow soft food. A 7 mm. esophagoscope could be passed through the stricture, and esophagoscopic dilation is being continued.

A résumé of diseases of the lower third of the esophagus with special reference to symptomatology, diagnosis and treatment has been set forth by Vinson.[47] The discussion includes varix, foreign body,

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44. Phelps, K. A.: Early Treatment of Chemical Burns of the Esophagus, Journal-Lancet **58**:237 (May) 1938.

45. Heatly, C. A.: The Treatment of Stricture of the Esophagus, Am. J. Surg. **42**:260 (Oct.) 1938.

46. Benedict, E. B., and Daland, E. M.: Benign Stricture of the Esophagus Complicating Duodenal Ulcer, New England J. Med. **218**:599 (April 7) 1938.

47. Vinson, P. P.: The Differential Diagnosis and Treatment of Lesions Obstructing the Lower Portion of the Esophagus, South. M. J. **31**:548 (May) 1938.

stricture, short esophagus, paraesophageal hernia, diverticula, cardiospasm and carcinoma, the two last occurring most frequently. Valuable aid in diagnosis is secured by roentgen studies and esophagoscopic findings.

Chitty [48] reported an interesting case of esophageal polyp accompanied by an accessory thyroid tumor. In addition to the enlargement of the thyroid in the right side of the neck, a long fleshy mass protruding 7 inches (17.8 cm.) beyond the incisor teeth was noted. Removal of this mass, which originated from the posterior wall of the pharyngoesophageal junction, was effected. The histologic diagnosis was polyp.

Rupture of the Esophagus.—Iglauer [49] reported spontaneous recovery in a case of rupture of the esophagus following attempted retrograde dilation of the esophagus. Roentgenograms taken after injection of iodized oil through the gastrostomy tube indicated that after the rupture mediastinitis and pleuritis must have ensued, with a fistula extending from the stomach through the esophagus and the mediastinum and terminating in the left main bronchus. They showed the distal end of the gastrostomy tube in the posterior mediastinum. This apparently provided a drainage tract from the mediastinum into the stomach and probably was instrumental in promoting the ultimate recovery of the patient.

Carcinoma of the Esophagus.—Carcinoma of the esophagus usually produces dysphagia; Vinson and Kimmelsteil [50] reported a case in which only respiratory symptoms were exhibited. Bronchoscopic examination revealed lateral tracheal compression due to an extrinsic lesion. On esophagoscopic examination the mass was seen to have displaced the esophagus, and the pressure on the trachea caused by the introduction of the tube produced so marked an increase in dyspnea that it had to be withdrawn without visualization of the lesion. Postmortem examination disclosed a carcinoma of the esophagus with an associated metastatic mediastinal mass producing obstruction of the trachea.

In an attempt to promote early diagnosis 100 cases of carcinoma of the esophagus were analyzed by Farrell.[51] The lesion occurred in the

48. Chitty, E. C.: A Case of Esophageal Polypus Accompanied by a Tumor of an Accessory Thyroid Gland, Brit. J. Surg. **26**:193 (July) 1938.

49. Iglauer, S.: Rupture of the Esophagus with Spontaneous Recovery of the Patient, Ann. Otol., Rhin. & Laryng. **47**:1083 (Dec.) 1938.

50. Vinson, P. P., and Kimmelsteil, P.: Carcinoma of Esophagus with Unusual Clinical Manifestations: Report of a Case, Ann. Otol., Rhin. & Laryng. **47**:804 (Sept.) 1938.

51. Farrell, J. T., Jr.: Integration of Clinical and Roentgenologic Findings in the Diagnosis of Carcinoma of the Esophagus, Radiology **30**:412 (April) 1938.

lower two thirds of the esophagus in over 75 per cent of the patients. One of the striking features was that 93 per cent of the patients were males. Dysphagia was the most constant symptom, followed, in the order of frequency, by pain, loss of weight and regurgitation. The diagnosis can be made early in the course of the disease by roentgen study, but the difficulty seems to be in getting patients to evaluate their symptoms properly and seek medical aid sooner.

Hiatal Hernia.—With a more careful study it has become apparent that the most common site for diaphragmatic herniation is through the hiatus oesophageus. Moersch [52] expressed the opinion that esophagoscopic examination may be a valuable aid in the proper evaluation of symptoms, in the differential diagnosis of the type of hernia and in determining the plan of treatment. Bleeding is an indication for esophagoscopic examination to determine the presence and extent of ulceration or erosion and to rule out carcinoma.

GASTROSCOPY

The studies by Douthwaite and Lintott [53] open a vast field for the investigation of effects of drugs on the mucosa of the stomach. To study gastroscopically the stomach's response to certain drugs it was necessary to devise a technic whereby a convenient administration of the drugs could be combined with reasonably prolonged endoscopic examination without materially increasing the slight discomfort that gastroscopic procedure involves. By experiment the investigators found it advisable to modify the technic in accordance with the physical characters and modes of exhibition of the substances used. For this purpose the drugs concerned were divided into three groups, namely, solids given by mouth, liquids given by mouth and substances injected. Their studies of acetylsalicylic acid and its effects were recorded.

Direct visualization of the interior of the stomach is an adjunct in diagnosis, and Moersch and Snell [54] pointed out its value in combination with clinical and roentgen findings. Gastroscopic examination should be utilized when there is any discrepancy in the routine studies, when roentgen findings demonstrate a lesion the nature of which is not apparent and when roentgenologic examinations cannot explain the persistance of postoperative symptoms. Likewise, the progress of gastric

52. Moersch, H. J.: Hiatal Hernia, Ann. Otol., Rhin. & Laryng. **47**:754 (Sept.) 1938.

53. Douthwaite, A. H., and Lintott, G. A. N.: Gastroscopic Observations of the Effect of Aspirin and Certain Other Substances on the Stomach, Lancet **2**: 1222 (Nov. 26) 1938.

54. Moersch, H. J., and Snell, A. M.: Gastroscopy in the Diagnosis of Gastric Disease, Am. J. Surg. **39**:521 (March) 1938.

lesions under a medical regimen can be closely followed. Clinical interest in all forms of gastritis has been stimulated by the frequency with which this condition is found gastroscopically. While the diagnosis of moderately advanced carcinoma usually can be made by roentgen examination, there may be difficulty in the early stages. In such cases gastroscopic examination is of definite value in establishing the nature of the lesion and also in giving information regarding its operability. While the endoscopic appearances of carcinoma vary, they are usually sufficiently characteristic and can hardly be mistaken for those of benign ulcer or one of the rare benign tumors of the stomach.

Direct visualization of the stomach affords the best means of recognizing gastritis. In recording their findings, Gaither and Borland [55] stated the belief that the simplest working classification is that of Schindler, with its division into superficial, atrophic and hypertrophic forms. Because of the wide variety of changes in the gastric mucosa and the insufficiency of pathologic control, it has been impossible to establish from gastroscopic appearances a criterion by which disease entities may invariably be recognized. Most gastritic stomachs show definite activity with evidences of inflammation, hypertrophy, ulceration, hemorrhage and localized injection; these comprise the groups with superficial and with hypertrophic gastritis. In a small percentage of cases the lesion seems inactive and atrophied; in these the atrophic form of gastritis is present.

After operation all the stomachs appeared definitely congested; the most marked atrophy was observed in cases of pernicious anemia.

Submucosal hemorrhagic areas have been observed in about 7 per cent of cases. The significance of these has not been determined.

Syphilis of the Stomach.—According to Carey and Ylvisaker,[56] English medical literature contains no gastroscopic description of gastric syphilis producing linitis plastica, or leather bottle stomach. In the case of a man aged 64, reported by them, there was loss of weight with practically no gastrointestinal symptoms. Serologic reactions for syphilis were strongly positive. Gastric analyses showed decrease in or absence of acid content. A diagnosis of linitis plastica was made by roentgen examination of the gastrointestinal tract. At gastroscopic examination the lumen of the stomach appeared to be contracted. The normal anatomic landmarks and all normal fields and rugations were effaced and replaced by broad, thick folds and indentations. The pyloric opening was of irregular shape, tending to be slitlike and partly open. The

55. Gaither, E. H., and Borland, J. L.: Gastroscopic Studies, J. A. M. A. **110**:436 (Feb. 5) 1938.

56. Carey, J. B., and Ylvisaker, R. S.: Gastroscopic Observation of Syphilis of the Stomach, Ann. Int. Med. **12**:544 (Oct.) 1938.

antrum appeared as a stiff, almost tubular structure, irregularly creased and indented and pinkish. Under appropriate antisyphilitic treatment restoration to the normal gastric appearances was progressing.

Chronic Gastritis.—In presenting their treatment for chronic gastritis, Swalm and Morrison [57] emphasized the importance of objective evidence, not only in diagnosis but also in evaluating the results secured by various therapeutic measures.

DUODENOSCOPY

Imperatori [58] has experimented with the duodenoscope in the study of the duodenum. Introduction of the duodenoscope is executed perorally by a guided thread and catheterization of the bile papilla is accomplished. Even though this procedure has not been attempted as yet on the living, it is hoped that perfection of the method will enable one to determine the patency of the cystic and common bile duct, study the uncontaminated bile and pancreatic juices and visualize adjacent structures by roentgenograms made after the introduction of opaque solutions.

1530 Locust Street.

57. Swalm, W. A., and Morrison, L. M.: Present Status of Treatment in Chronic Gastritis: Gastroscopic Observations, Am. J. Digest. Dis. **5**:472 (Oct.) 1938.

58. Imperatori, C. J.: Some Experimental Studies of Peroral Catheterization of the Common Bile Duct, Ann. Otol., Rhin. & Laryng. **47**:807 (Sept.) 1938.

Abstracts from Current Literature

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OTOGENOUS NONPURULENT ENCEPHALITIS. ERIC JERLANG, J. Laryng. & Otol. **53**:283 (May) 1938.

Borries in 1921 was the first to describe uncomplicated nonpurulent encephalitis as one of the otogenous intracranial complications.

While it had been recognized that encephalitis could result as a consequence of hematogenous metastasis in cases of purulent otitis, it was thought that such a condition was always a preliminary stage to cerebral abscess and that it did not exist as an independent malady. In a consideration of the cerebral complications of otitis, Borries proposes a classification which treats nonpurulent inflammation as an independent disease.

Simple encephalitis consists only of macroscopically detectable perivascular leukocytic infiltrations. Hemorrhagic encephalitis is more severe than the simple variety and results in visible hemorrhagic infiltrations of the cerebral tissue. While it frequently occurs with, or as a preliminary stage of, abscess, it may develop independently without tendency to suppuration. Purulent encephalitis, the third in the group of cerebral complications, is, of course, abscess of the brain.

A group of cases is presented to illustrate the picture of nonpurulent encephalitis, and the symptoms vary widely. The onset may be slow or sudden; the condition occurs more often in children and young adults and is seen in connection with both acute and chronic otitis. The symptoms are chiefly those of abscess, and, as Borries has said, "this type of encephalitis is a syndrome of abscess symptoms without abscess." The diagnosis, if made, is achieved by exclusion. Of interest from the standpoint of differential diagnosis are the high temperature and the absence of bradycardia in the reported cases. The cerebrospinal fluid varied in every imaginable manner, from a normal condition to high pressure with many cells.

Exploration of the brain was resorted to in all but 1 of the cases, and in none was pus obtained. Since in this condition abscess cannot be definitely excluded, the treatment must be that of abscess. When no abscess is located, however, the question arises whether an undetected area of suppuration is present. It is believed that this has not been the case in the present series. Since all the patients recovered, this contention could not be disproved. LEJEUNE, New Orleans.

INFLUENCE OF THE "HORMONES OF PREGNANCY" ON THE BONY LABYRINTHINE CAPSULE OF THE GUINEA PIG: A CONTRIBUTION TO THE STUDY OF OTOSCLEROSIS. W. SOMMERFELD, Rev. de laryng. **59**:389 (April) 1938.

The author discusses the predominance of otosclerosis in female patients and the statistical relation between otosclerosis and pregnancy. His experiments, which he considers incomplete, were done on 3 young guinea pigs, 2 female and 1 male. He used the urine of pregnant women for injection and found that this was well tolerated by the female animals (twenty-two and twenty-eight injections). The male guinea pig died after the nineteenth injection; it showed a poorly developed labyrinth, with many islands of cartilage. BATSON, Philadelphia.

CHANGES IN HEARING AND IN THE ORGAN OF EQUILIBRIUM DURING PREGNANCY AND LABOR. A. RADZYMINSKI, Rev. de laryng. **59**:504 (May) 1938.

Studies were carried out on 100 women during pregnancy and the puerperium and after the termination of lactation. Patients from the gynecologic clinic were

used as controls. Only 10 of the subjects were examined with an audiometer. Galvanic, caloric and rotation tests were used in examining the static labyrinth. No change in the relation of air and bone conduction was found, and no great variation in the hearing was observed in any case. Slight differences observed at 128 and 256 double vibrations may have been due to edema of the rhinopharynx in pregnancy. The increased irritability of the static organ during pregnancy is probably a vasomotor disturbance and may be of parathyroid origin.

BATSON, Philadelphia.

METHOD OF ISOLATED EXAMINATION OF A SINGLE EAR. J. MIODONSKY, Monatschr. f. Ohrenh. **72**:984 (Oct.) 1938.

The writer did some experimental work with the S audiometer of Schwarz and found that the vibration of air in the external auditory canal is transmitted to the walls and the neighboring tissue of the canal. This vibration is propagated through the skull into the cochlea of the other side. Therefore, the audiometer is capable of discovering hearing even in cases in which the internal ear has been surgically removed.

LEDERER, Chicago.

PRESENT STATUS OF OTOSCLEROSIS, WITH A REVIEW OF THE TREATMENT. MAX MEYER, Pract. oto-rhino-laryng. **1**:145 (July); 273 (Sept.) 1938

The author has made a complete review from many angles of the present theories concerning otosclerosis. He states that the diagnosis cannot be established with any certainty, for the condition is not a clinical symptom complex but a pathologic anatomic change of the bony labyrinthine capsule. This bony change is usually situated on the superior-anterior border of the oval window and sooner or later interferes with the movement of the footplate of the stapes. Clinically, the ear drum appears normal but may occasionally be somewhat reddened; normal pneumatization of the mastoid process appears on roentgen examination; tinnitus and prolonged bone conduction are present.

Heredity may play a role, and, since it has been shown that women are more susceptible than men to this disease, particularly during the years of childbearing, which suggests a break during puberty, pregnancy or the climacteric, an endocrine element may be a factor. The author states that in cases of mild otosclerosis pure conductive deafness may be present, which may yield to medical treatment on the assumption that the ankylosis is reversible, but that when the ankylosis is irreversible medical treatment cannot benefit the patient. The prognosis in every case of true otosclerosis which shows involvement of the usual site of predilection is that the disease will progress and, with later association of labyrinthine degeneration, lead to total deafness.

Discussing the histologic picture and the histogenesis of the disease, the author states that it is closely associated with osteodystrophia fibrosa (von Recklinghausen's disease) and Paget's disease. In view of the great similarity of the pathologic picture of the temporal bone in otosclerosis and that in the long bones in osteodystrophia fibrosa, he suggests that more careful study of the general skeletal bones be made in all cases of otosclerosis. He presents five stages of the development of the otosclerotic process in the temporal bone, and, while his theory of venous stasis differs to a certain degree from Wittmaack's, the difference depends purely on the stage of observation, for he believes that the stage of stasis (Wittmaack's first stage) is comparable to the third and fourth stages in his classification.

The author believes that the causes of otosclerosis should be viewed from a hereditary constitutional standpoint, since endogenous and exogenous metabolic factors may play a role. He does not agree with the theory of Mayer that the labyrinthine capsule is spontaneously fractured, with subsequent repair and ankylosis. He states further that it is difficult to prove that the local process in the

labyrinthine capsule can arise from an endochondral reaction rather than a periosteal reaction. The question of metabolic disturbances producing deficiency of calcium and vitamin D is discussed. He feels also that mineral metabolism and the glands of internal secretion, with their relation to the sympathetic and the parasympathetic system, may play a role.

In discussing the treatment of otosclerosis, the author states that the most favorable results are achieved in cases in which ankylosis has not occurred or in which the disease may be localized to a silent area of the capsule, but there are no definite criteria to establish this group. He recommends calcium and solution of parathyroid. Some cases have been reported wherein the hearing was improved by extirpation of the parathyroids or ligation of the branch of the inferior thyroid artery. He states that patients with definite ankylosis of the stapes perhaps may be aided only through the use of hearing aids. He discusses operative therapy and the various methods, including those of Holmgren and Sourdille, and then submits a method of his own, namely, a suboccipital puncture, which will decrease the interlabyrinthine fluid. He cites 6 cases in which he withdrew 30 to 40 cc. of spinal fluid, with a variable influence on both the hearing and the tinnitus. His method of treatment is based on the theory that in a number of cases there is an obstruction in the ductus perilymphaticus in the region of the round window which prevents the liquor endolymphaticus from escaping. He states further that this method of treatment is applicable in a relatively limited number of cases.

PERSKY, Philadelphia.

MIDDLE EAR INSUFFICIENCY: A FUNCTIONAL DISEASE OF THE MIDDLE EAR. F. KOBRAK, Pract. oto-rhino-laryng. **1**:293 (Sept.) 1938.

The author states that there are certain forms of central cochlear disease wherein the auditory picture resembles middle ear deafness more closely than inner ear deafness. This phenomenon may represent a reflex tonic influence on the muscles of the middle ear (the tensor tympani and the stapedius) coming from the cochlear nucleus to the facial and the trigeminal nucleus. These muscles do not produce a coarse dampening of the sound waves with throttling or further impairment of the hearing but rather refine the sound waves for hearing.

The author feels that the spastic states are directly related to a hyperergic condition which may cause an increase of pressure on the oval window and so produce secondary degeneration of the auditory end organs. Since catarrh of the middle ear is frequently associated, inflation of the eustachian tube will produce beneficial results to a certain extent, influencing only the middle ear insufficiency or the middle ear component of the combined middle ear and inner ear deafness. Now, while this inflation may influence the muscular pressure to a given degree and for a certain time, it has no influence on the course of the primary auditory nerve deafness. In some cases degenerative disease of the cochlea, which may be due to definite spastic symptoms, may present a picture of a spasmophilic type of deafness.

The author believes that there are four types of nerve deafness: (1) auditory degeneration without any evidence of disease of the middle ear, as in cases of acute postinfectious neuritis of the cochlear nerve and destruction so rapid that the reflex irritative factor with secondary involvement of the muscles of the middle ear cannot occur, (2) degeneration of the auditory nerve with involvement of muscles of the middle ear but without spasmophilic association, (3) degeneration of the auditory nerve with involvement of the muscles of the middle ear and spasmophilic association but without spongification of the labyrinthine capsule, (4) a combination of all four stages including spasmophilic otosclerosis in which a nerve seems to be infected from the very beginning.

In the summary, the author stresses the value of catheterization of the eustachian tube and also states that in the cases considered insufficiency of the muscles of the middle ear may be present in addition to disease of the inner ear.

PERSKY, Philadelphia.

Nose

EXTREME DISFIGUREMENT RESULTING FROM OPERATION ON FRONTAL SINUS, CORRECTED WITH GRAFT OF RIB CARTILAGE. B. FOSTER, Australian & New Zealand J. Surg. **8**:85 (July) 1938.

A patient with a large frontal sinus required complete removal of the outer bony plate. Foster had used fat grafts to correct such deformities in the past, but with slight success.

In this case, eighteen months after operation Foster filled out the depressions with cartilage. A six month follow-up has shown that the operative wound is well healed and the recovery uncomplicated, and the photographs attest to the excellent cosmetic result.

MILLER, Philadelphia.

OSTEOMYELITIS OF THE SKULL. A. E. SITSEN, Monatschr. f. Ohrenh. **72**:729 (Aug.) 1938.

After a short description of the microscopic structure of the bones of the skull, Sitsen describes the microscopic findings in 11 cases of osteomyelitis cranii. Aside from traumatic, metastatic osteomyelitis and osteomyelitis following purulent diseases of the paranasal sinuses, the author mentions also "primary osteomyelitis," which is probably a metastatic osteomyelitis with an unknown primary focus or with a primary focus healed when the osteomyelitic process appears. Osteomyelitis of the bones of the skull is more frequent than is usually believed, but the disease often remains latent and heals spontaneously. According to the author it is rare that rapidly progressive osteomyelitis is observed. In most of his cases the (internal or external) periosteum became affected first of all, although he found that at times the bacteria invaded the marrow immediately. When the osteomyelitis is fully developed, the entire soft tissue of the bone (marrow, periosteum and endosteum) is involved.

The destruction of the afferent arteries of the bone is the principal reason for the development of necrotic bone. The early developing thromboses of the veins of the bone favor the expansion of the inflammation. From the anatomic point of view there are to be differentiated (*a*) exudative (purulent) osteomyelitis of the vault of the skull with necrosis of bone and (*b*) productive inflammation, developing sometimes from the purulent form and characterized particularly by an increased apposition and destruction of bony substance. The tabula interna and tabula externa of the bones are usually destroyed, while the diploe withstands the onslaught over a longer period. Small sequestrums of the bone can be surrounded by newly formed bone and can heal spontaneously. Large sequestrums usually hinder the outflow of the exudate. Osteomyelitis spreads most commonly along the external periosteum and between the bones of the skull and the dura, while the expansion through the marrow is of less importance in the process. It is intended that the treatment shall consist of procuring the best chances for the outflow of the exudate. Particular stress is placed on the epidural abscesses which sometimes develop in places where no inflammation of the bone is seen. Twenty photomicrographs illustrate the article.

LEDERER, Chicago.

Miscellaneous

PHYSIOPATHOLOGIC AND PATHOANATOMIC ASPECTS OF MAJOR TRIGEMINAL NEURALGIA. F. H. LEWY and FRANCIS C. GRANT, Arch. Neurol. & Psychiat. **40**: 1126 (June) 1938.

Through the use of graduated hairs or thorns and electricity, the authors have found in 25 per cent of their patients with trigeminal neuralgia a reduction in the number of points sensitive to touch and pain. In addition, greater and longer stimuli were needed to produce a sensation. The important idea brought out is

that trigeminal neuralgia is a special form of thalamic syndrome caused by functional or organic vascular insufficiency. The authors state that in 32 per cent of their patients with trigeminal neuralgia the slow response with long after-effects, the high threshold of stimuli, the tendency to explosive reactions and the excessive feeling tone of sensations were not confined to the face but extended over one side of the body. Because these signs point to the region of the optic thalamus as the possible site of the lesion in major trigeminal neuralgia, histologic examinations were made of the brain in 6 cases. In addition to cortical atrophy, there was a decrease in the white matter, with widening of the lateral ventricle and thalamic degeneration. In discussing the origin of the loss of neural tissue, two possibilities are considered: (1) bilateral softening of the internal and lateral thalamic nuclei; (2) a vascular lesion in the corona radiata.

The interruption of the thalamocortical fibers resulted in secondary degeneration toward the cortex, and retrograde degeneration in some nuclei of the optic thalamus. In 5 cases, in which the lesion was unilateral, the focus was on the side of the neuralgia.

The authors feel that an encephalogram made after injection of air may disclose atrophy if sufficiently marked and that this examination may help in differentiating typical and atypical neuralgia. An encephalogram made in a case of typical trigeminal neuralgia on the left side is shown, disclosing atrophy of the left hemisphere, collection of air over and between the atrophic gyri, enlargement of the left lateral ventricle and atrophy of the right island.

In discussing the assumption that major trigeminal neuralgia is a special form of the thalamic syndrome and not an accidental observation in elderly persons, the authors cite a therapeutic experiment on a patient. The latter had all classic signs of a thalamic hemorrhage, with intolerable pain over one entire side of the body. Dr. C. H. Frazier blocked the fifth nerve, thus relieving the pain in the face. A chordotomy checked the impulses of pain from the afflicted side of the body. Thirteen days after operation, the patient was free from pain. This case seemed to prove the theory that relief from afferent impulses abolished the appearance of paroxysms.

The authors cite animal experiments made by Drs. F. H. Lewy and G. D. Gammon, who showed that the spontaneous electrical activity of the thalamus and cortex depends to a certain degree on, and is modified by, the continual influx of sensory impulses from all parts of the body, especially, at least in cats, from the trigeminal area.

They also state that anatomic study has established the fact that the secondary trigeminal fibers end within the semilunar nucleus of the optic thalamus and that the median center and the face, as a rule, do not become involved unless the thalamic lesion is unusually extensive. In addition, patients with trigeminal neuralgia have pains in other parts of the body, particularly the brachial, intercostal or sciatic nerves, and sensory anomalies. The authors bring out the important observation made in the study of the physical condition of their 50 patients. Only 6 of the 50 were entirely free of symptoms of vascular disease. Over 60 per cent had definite arteriosclerosis and renal dysfunction.

H. H. VAIL, Cincinnati.

ECONOMY IN MEDICATION. BERNARD FANTUS, J. A. M. A. **110**:880 (March 19) 1938.

Fantus presents an interesting résumé of the economies possible if physicians in prescribing bear certain principles in mind. These principles are as follows: 1. Inferior medication should never be resorted to; only the most efficient should be prescribed. Often the most efficient is found to be the cheapest. 2. Among drugs of equal efficiency the least expensive should be chosen.

Economy in prescribing medication pays, for it will lead to a great saving to patients and to hospitals and promote the best possible cooperation between the physician and the pharmacist, all for the benefit of the patient.

A number of drugs are discussed under different captions and are elaborated on in tables. Since some of the drugs are used frequently in otolaryngologic practice, the important conclusions of this paper are briefly set forth:

Of the hypnotics, chloral hydrate and barbital are the most efficient and at the same time much cheaper than the others. Of the analgesics, acetanilid in doses of 0.1 Gm. is most effective and cheapest. This valuable drug was formerly given in excessive doses, too frequently and over too long periods—hence its untoward action and abandonment by most physicians. Mercury bichloride (1:1,000) is the best of the cutaneous disinfectants and has several other properties (absence of odor, harmlessness to rubber gloves, etc.) which place it first in effectiveness as well as in economy. Certain economies could be effected by buying anesthetics in larger quantities, e. g., U. S. P. ether in 27 pound (12.2 Kg.) drums instead of ¾ pound (113 Gm.) cans.

It should be remembered that chemicals listed in the Pharmacopeia of the United States and the National Formulary are as effective as and at the same time much cheaper than the identical chemicals produced by the manufacturing chemists and listed under proprietary names.

The following facts are most illuminating and need no further comment: the price of acetophenitidin is one-third that of its proprietary analog, phenacetin; of aminopyrine, nearly one-half that of pyramidon; of acetylsalicylic acid, one-fifth that of Bayer aspirin; of barbital, one-sixth that of veronal; of cincophen, one-eighth that of atophan; of methenamine, less than half that of urotropin; of neocinophen, half that of otolysin; of phenobarbital, one-tenth that of luminal, and of thymol iodide, one-fourth that of aristol.

GORDON, Philadelphia.

ANAEROBIC BETA HEMOLYTIC STREPTOCOCCUS MENINGITIS OF OTITIC ORIGIN TREATED WITH SULFANILAMIDE AND CULMINATING IN COMPLETE RECOVERY. FRED W. SMITH and others, J. A. M. A. **110**:887 (March 19) 1938.

Smith and his associates, mindful that a number of patients have recovered from meningitis caused by the beta hemolytic streptococcus after treatment with sulfanilamide, report a case of meningitis caused by an anaerobic beta hemolytic streptococcus in which sulfanilamide therapy produced recovery. A brief report of the case follows: A white girl aged 21 complained of sore throat and backache. The temperature was 103.4 F., and the throat was acutely inflamed and covered with numerous white patches. Three days later the pharyngeal infection subsided. On the fourth day she had severe otalgia on the left, necessitating a myringotomy. Free drainage with rapid improvement took place within ten days. She was symptom free and left for the seashore to recuperate. Fifteen days after the myringotomy she returned from the shore with an acute exacerbation of all symptoms. Examination revealed a pulsating seropurulent discharge from the left canal with a sagging of its superoposterior wall and tenderness of the tip of the mastoid process. There was some nuchal rigidity. The temperature was 102 F. The patient was admitted to the hospital sixteen days after the myringotomy, when the white blood cell count was 13,800, with 88 per cent polymorphonuclears. Blood cultures showed no organisms. Roentgen examination revealed incomplete occlusion of the cells of the left side, coalescence of the cells over the sinus and no involvement of the petrous pyramid. The following day (the seventeenth after the myringotomy) simple mastoidectomy on the left was performed. There was no growth aerobically from the culture of material from the mastoid, the smear showing many pus cells but no bacteria. Two doses of 4-sulfamidophenyl-2′-azo-7′-acetylamino-1′-hydroxynaphthalene-3′,6′ disulfonic acid (prontosil) were given within the first twenty-four hours. The patient seemed to improve until the fifth postoperative day, when she complained of frontal headache. Neurologic and ophthalmologic examination showed no abnormality, and the white blood cell count was 12,500, with 88 per cent polymorphonuclears. On the tenth postoperative day the temperature rose to 103.2 F. and the white blood cell count to 14,600, with

88 per cent polymorphonuclears. Nuchal rigidity, diplopia and a positive Kernig sign were present. An injection of 15 cc. of prontosil was given intramuscularly. A spinal tap revealed turbid fluid under pressure, 360 cells per cubic centimeter, all polymorphonuclears, and increased globulin; a smear revealed occasional gram-positive cocci in pairs and in short chains; culture showed anaerobic beta hemolytic streptococci. The dose of prontosil was increased to 30 cc. every eight hours. Neurologic examinations were repeated. The possibility of spinal thrombosis and of localized collections of extradural pus was eliminated. The diagnosis of purulent meningitis of otitic origin was confirmed. Sulfanilamide was given orally at the rate of 10 grains (0.6 Gm.) every fourth hour. On the eleventh postoperative day the temperature came down to normal and remained there. On the twelfth postoperative day some cyanosis developed, so that two doses of sulfanilamide were omitted. The temperature promptly rose to 102.4 F. The administration of sulfanilamide was continued thereafter regularly, and a spinal tap was done daily. Some diplopia and left convergent squint were noted; otherwise the neurologic examination showed no abnormality. The temperature remained normal. Retinal examinations showed nothing abnormal. Two transfusions were given to maintain the hemoglobin and the erythrocyte count at a near normal level. The white blood cell count was normal after the twelfth postoperative day. Chemical analysis of the blood showed normal amounts of urea, sugar, chlorides and carbon dioxide. The sulfanilamide therapy was continued, 10 grains (0.65 Gm.) being given every four hours until the nineteenth postoperative day, when the dose was reduced to 5 grains (0.32 Gm.) every four hours. On the twenty-sixth postoperative day it was stopped. The patient was discharged on the twenty-eighth postoperative day in good condition. She has been seen repeatedly since and is well.

"*Description of the Streptococcus.*—An obligate anaerobic beta hemolytic streptococcus was isolated on a blood agar plate by the gaseous displacement and palladinized asbestos technic of [J. E.] Weiss and [E. H.] Spaulding (*J. Lab. & Clin. Med.* **22**:726 [April] 1937). The colony was slightly granular, grayish white and opaque, with an entire border approximately 1 mm. in diameter and surrounded by a zone of hemolysis 3 mm. in diameter. This strain occurred in chains of from eight to twelve cocci when grown in brain broth mediums under anaerobic conditions. It required strict anaerobic conditions for growth. It has failed repeatedly to grow aerobically on blood agar plates or in unheated brain broth tubes after repeated transplants on anaerobic blood agar slants."

GORDON, Philadelphia.

Book Reviews

Diseases of the Ear, Nose and Throat. By FRANCIS L. LEDERER, M.D., F.A.C.S., Professor and Head of the Department of Laryngology, Rhinology and Otology, University of Illinois, College of Medicine; Chief of the Oto-laryngological Service, Research and Educational Hospital. Price, $10. Pp. 835, with nearly 500 halftone and line engravings and 16 full page colored plates. Philadelphia: F. A. Davis Company, 1938.

Dr. Lederer and his associates in the department of laryngology, rhinology and otology of the University of Illinois College of Medicine contributed a textbook which contains the following sections: (1) "Diseases of the Ear," (2) "Diseases of the Nose and Sinuses," (3) "Diseases of the Pharynx," (4) "Diseases of the Larynx, Trachea, Bronchi and Esophagus" and (5) "Correlated Considerations."

The entire format of the book—the type, the binding, the paper and the arrangement of the page in two columns—will undoubtedly appeal to every reader.

The author possesses the gift of letters, and throughout the text one is impressed by the grammatical purity. The theme is coherently and lucidly presented in a style that makes for easy reading. The anatomy, pathology, differential diagnosis, prognosis and treatment of each condition are outlined in detail, yet with verbal paucity, because of the rhetorical finesse. Several hundred illustrations and a number of full page colored plates enhance the value of the text, and many of the photomicrographs, e. g., those dealing with the various types of polypi, clarify some points of teaching that are insufficiently stressed in other works. The diagrams, sketches, schemata and histologic studies of the section devoted to the ear are worthy of glowing comment. All the other sections, moreover, contain numerous roentgenograms and drawings of dissections. Most of the sketches are clearly labeled.

Forty-one pages of the text are devoted to a study of correlated considerations, which include many phases connected with general medicine.

Over four pages are devoted to allergy. Headache, cough, facial neuralgia, enlargements of the neck, disorders of speech, legal medicine and similar topics that connect the field of otolaryngology with many other fields are discussed in the same thorough manner as the other subjects.

I should have liked to see a more detailed discussion of the technic of catheterization of the pharyngeal orifice of the eustachian tube (page 122) and of bronchial lavage as an office procedure (page 696).

Every form of therapy is thoroughly evaluated, and the policy of the entire work is rational, precise and in accordance with tested procedures.

The book is recommended for medical students, for general practitioners, for gradute students in otolaryngology, for those taking residencies and, as collateral reading, for the otolaryngologist.

Surgery of the Ear. By Samuel J. Kopetzky, M.D., F.A.C.S., Editor. Professor of Otology, New York Polyclinic Medical School and Hospital; Attending Otolaryngologist, Beth Israel Hospital, New York. Price, $12. Pp. 468, with 292 illustrations and 4 color plates. New York: Thomas Nelson & Sons.

This new book, appearing in loose leaf form, represents the contribution of a number of otologists, under the editorial supervision of Dr. Samuel J. Kopetzky. The illustrations are fine, the printing good and the arrangement of the various subjects satisfactory. A certain amount of redundance and circumlocution exists, but this can be condoned because of the interlocking of the material presented.

All phases of otologic surgery and technic are fully discussed, inflammatory and infectious states occupying the major portion of the work. Chapters on the

surgical treatment of facial paralysis, Ménière's disease, otosclerosis, acoustic nerve tumors and tumors of the temporal bone are presented by men high in their special fields.

The loose leaf arrangement makes it possible to keep up to date with the newer advances in otologic surgery.

This book cannot supplant the standard textbooks, nor would it be practicable for undergraduate teaching. It will be of great use to the otologist as a reference book, as it is up-to-date on all surgical procedures and diagnosis. It is authoritative because of the distinguished clinicians who have contributed chapters, namely: Drs. Matthew S. Ersner, Oscar V. Batson, Lester M. Hubby, Horace J. Williams, Ralph Almour, James A. Babbitt, John R. Page, Harold I. Lillie, James G. Dwyer, Leo M. Davidoff, Leroy A. Schall, Thomas G. Tickle, Ernest Sachs, Walter E. Dandy, Gunnar Holmgren and Curt Engelmann.

News and Comment

The annual meeting of the American Laryngological, Rhinological and Otological Society, Inc., will be held at the Drake Hotel in Chicago on May 9, 10 and 11.

The scientific program includes symposiums on the care of the patient after operation for sepsis of otitic origin, on the care of mastoidectomy wounds, on the final results of operation for chronic suppurative paranasal sinusitis, and on defects of the voice. It is hoped that there will be free discussion from the floor.

Directory of Otolaryngologic Societies *

FOREIGN

Collegium Oto-Rhino-Laryngologicum Amicitiæ Sacrum

President: Dr. Louis Ledoux, Brussels, Belgium.
Secretary: Prof. Dr. C. E. Benjamins, Verlengde Heereweg 143, Groningen, Netherlands.
Place: Brussels, Belgium. Time: September 1939.

Hungarian Otolaryngological Society

President: Dr. J. Treer, Bocskay-u. 9, Szeged.
Secretary: Dr. G. Kelemen, Reáltanoda-u. 9, Budapest.

Sociedad Rioplatense de Oto-Rhino-Laringología (Argentine Section)

President: Dr. Raul Becco, B. Mitre 1690, Buenos Aires.
Secretary: Dr. Juan Manuel Tato, Santa Fé 1171, Buenos Aires.

Société Française d'Oto-Rhino-Laryngologie

Secretary: Dr. Henri Flurin, 19 Avenue Mac-Mahon, Paris, 17e.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. H. Marshall Taylor, 111 W. Adams St., Jacksonville, Fla.
Secretary: Dr. Leroy A. Schall, 270 Commonwealth Ave., Boston.
Place: St. Louis. Time: May 15-19, 1939.

American Academy of Ophthalmology and Otolaryngology

President: Dr. George M. Coates, 1721 Pine St., Philadelphia.
Executive Secretary: Dr. William P. Wherry, 1500 Medical Arts Bldg., Omaha.
Place: Chicago. Time: Oct. 8-13, 1939.

American Bronchoscopic Society

President: Dr. John D. Kernan Jr., 120 E. 75th St., New York.
Secretary: Dr. Lyman Richards, 319 Longwood Ave., Boston.
Place: Westchester Country Club, Rye, N. Y. Time: May 27, 1939.

American Laryngological Association

President: Dr. George B. Wood, 504 Physicians' Bldg., Philadelphia.
Secretary: Dr. James A. Babbitt, 1912 Spruce St., Philadelphia.
Place: Westchester Country Club, Rye, N. Y. Time: May 24-26, 1939.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Harold I. Lillie, Mayo Clinic, Rochester, Minn.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Place: Drake Hotel, Chicago. Time: May 9-11, 1939.

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* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

SECTIONS:

Eastern.—Chairman: Dr. Frank E. Kittredge, Masonic Temple, Nashua, N. H.
Southern.—Chairman: Dr. Francis E. LeJeune, Maison Blanche Bldg., New Orleans.
Middle.—Chairman: Dr. T. R. Gittins, Davidson Bldg., Sioux City, Iowa.
Western.—Chairman: Dr. Frederic G. Sprowl, Medical Arts Bldg., Spokane, Wash.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Isidore Friesner, 36 E. 73d St., New York.
Secretary: Dr. Thomas J. Harris, 104 E. 40th St., New York.
Place: Westchester Country Club, Rye, N. Y.: Time: May 22-23, 1939.